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FROM

Prof. Trowbridge.

18 Oct 1899.

SYNOPSIS

OF

CURRENT ELECTRICAL LITERATURE.

SYNOPSIS

OF

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COMPILED FROM THE FOLLOWING TECHNICAL JOURNALS AND MAGAZINES DURING 1895.

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INTRODUCTION.

THIS "Synopsis of Current Electrical Literature" is the first publication of its kind in the English language, and the undersigned is fully aware of many criticisms that may be made regarding this book. In fact, a synopsis, index, digest—whatever one may call it—may be prepared in as many different ways as we find people to do the work. Opinions on the proper method vary widely, since different classes of the profession want to use a work of that sort for different purposes, and it is, therefore, not out of place to state here what the object of this Synopsis is—what it pretends to do—what it intentionally tries to avoid, and then leave it to the kind judgment of its readers to say whether it has reached its goal or not.

The principal aim has been to give the headings and names of authors of the most important articles pertaining to electricity published in the English, German and French languages during the past year. Many of those articles have been reprinted in several publications, not infrequently translated, either in full or in abstract; it was, therefore, deemed advisable to mention the principal journals which printed or reprinted such papers in order to give those desiring to read the subject matter in detail the opportunity to procure such papers as are easiest obtainable.

The brief remarks following the titles are not intended to be so full as to give the reader all the information he may want, concerning the specific article, but they are given simply to call attention to the line of thought followed by the author, or to give a clue to the method of treatment pursued in order that one may judge whether it is of the character sought for.

Cross references have been almost entirely avoided in order not to make the book too voluminous, but great care has been exercised in selecting the headings of the various branches.

The book, as a whole, is practically a rearranged and revised reprint of the monthly synopsis which have appeared in ELECTRIC POWER during the year 1895.

MAX OSTERBERG.

ALTERNATING CURRENTS.

The Best Frequency for Alternating Current Installations. By E. Kolben. In a paper published in the *Elektrotechn. Zeitschrift*, the writer discusses the various phenomena which depend on frequency and finds that there is no best frequency for general use, but that for short distances 50 to 60 periods correspond best with the large claims of an economical installation with high efficiency, good regulation and reliable working. ELECTRIC POWER, Dec., '94.

Influence of Form of Curves of Alternators on Motors. By Emil Kolben, Oerlikon. Results of about 100 experiments showed that a properly constructed motor is independent of the construction of the dynamo. A number of curves found by experiment form part of the paper. *Elektr. Zeitschr.*, Dec. 20, '94.

Notes on Rotary Field Motors. By S. P. Thompson. In the London *Electrician* the following points are discussed: 1. Elementary Theory of Rotary Field Motors; 2. Resultant Magnetic Flux in Motors; 3. Conditions of Operation; 4. Starting Torque of Impressed Field is Limited; 5. Relation between Torque and Slip. *Elec. World*, Dec. 22, '94.

On the Production of Rotary Magnetic Fields by a Single Alternating Current. Read before the American Institute of Electrical Engineers, December 19, 1894. By Ludwig Gutmann. The paper explains a method of constructing an armature with respect to the field that no synchronism is necessary to make a motor turn and develop torque. *Trans. Am. Inst. Elec. Eng'rs*, Dec.; *Elec. Review*, Dec. 26; *Elec. Eng'r*, Dec. 29; *Elec. Age*, Dec. 29., '94.

Alternating Current: Its Generation and Distribution. The fourth of a series of articles by Prof. George D. Shepardson. *Elec. Industries*, Jan., '95.

Alternating Rotary Field and Its Uses. By Riccardo Malagoli. A few theoretical remarks and some practical conclusions as to the construction of dynamos and transformers. *L'Éclairage Électrique*, Jan. 5, '95.

Comparative Study on the Economy of Single and Multiphase Currents. Paper read by Hans Görges before the "Elektrotechnischen Verein," Dec. 18, '94. Without going into the details of this paper, we will just cite the closing remarks of the speaker. He concludes: 1. The three-phase system is more economical than the two- or one-phase, especially for long distances; 2. The regulation of the rotary field offers no difficulties; 3. Multiphase motors are cheaper in first cost, more economical in running and cause less disturbance in the light than other alternating current machines. The paper was discussed by Messrs. Roos, Weber and Kapp. *Elektrotech. Zeitschrift*, Jan. 17, '95.

Alternating Current Motors. By L. M. Pinolet. The first of a series of articles, in which the writer discusses synchronous and multiphase motors. *Die Elektrizität*, Feb., '95.

Calculation of Polyphase Current Plants. By Dr. Ludwig Fischer. The writer deduces equations on which the calculations for polyphase current plants are based; then he considers some additional expedients which permit close calculation by means of some simple formulae. *Elektrotechn. Zeitschrift*, Feb. 7, '95.

Rotary and Alternating Current Machinery of the Allgemeine Elektrizitœtsgesellschaft. By M. von Dolivo-Dobrowolsky. Paper read before the Elektrotechn. Verein, Jan. 22, '95. Besides the mechanical advantages, the writer points out the various electrical advantages of the rotary system, and cites numerical values. *Elektrotechn. Zeitschrift*, Feb. 7, '95.

The Monocyclic System. An account of the monocylic motors, taken from the patent records. *Elec. World*, Feb. 9, '95.

Theory and Properties of Synchronous Motors. By André Blondel. The first of a series of papers. *L'Industrie Electrique*, Feb. 10, '95.

Constancy of the Rotary Magnetic Field. By Chas. T. Rittenhouse, M.E., E.E. Theoretical reasoning leads us to the conclusion that if iron followed all the impulses of impressed magnetomotive forces, then a rotary magnetic field, produced by polyphase currents in any one of the prevailing methods, should fluctuate in its intensity. This paper contains an experimental investigation, the object of which was to determine to what extent the above assumption is fulfilled under practical conditions. ELECTRIC POWER, March, '95.

The Practical Application of Alternating Current Motors. By Walter J. Fryer, A.I.E.E. Abstract of paper read before the Institute of Junior Engineers, Feb. 15, '95. The author first considers alternating currents from their theoretical aspect, and afterwards follows on with illustrations of how alternating current motors have been successfully applied in practice. *London Electrical Engineer*, March 1st, '95.

Alternating Current Motors. By L. M. Pinolet. The second of a series of articles. The paper does not contain any mathematics, but is simply descriptive. *Die Elektricität*, March 2, '95.

Method for obtaining Alternating Current Circuits. By Louis Duncan. Description of a modified form of using the telephone for this work. *Electrical World*, March 2, '95.

The Monocyclic System for Light and Power Distribution. By Dr. Louis Bell. In this article we find not only a thorough review of the various systems of light and power distribution,—not only a careful comparison between the various alternating current systems, but also a clear and concise statement of the monocyclic system and a description of its working. *The Engineer*, March 6, '95; *Elec. Review*, March 6, '95; *Electrical World*, March 9, '95. This paper was

also reprinted and discussed in *Electrical Engineer*,(London,) March 6, '95; *Electricity*, March 6, '95; and *Elektrotechn. Anzeiger*, April 14, '95;

On Unipolar Induction and Alternating Current Machines with Non-movable Windings. By Prof. E. Arnold. The unipolar induction cannot become a factor of great importance in the construction of the continuous current dynamo. With this statement the speaker started his paper. He then points out that for the construction of alternating current work this principle can very successfully be utilized, and after the definition of certain fundamental facts, goes into the details of a design of this type. The paper is given in full in *Elektrotechn. Zeitschrift*, March 7, '95.

Definition of Polyphase System. A number of letters by Ludwig Gutmann, Harris J. Ryan, Reginald A. Fessenden, D. C. Jackson and F. E. Nipler, in which these gentlemen give their view on the above subject. *Elec. World*, March 30, '95.

Action of a Single Phase Synchronous Motor. By Bedell and Ryan. Published in the *Transactions* of the Franklin Institute. The *Elektrotech. Zeitschrift* refers to this paper editorially and gives a complete translation. The editors consider it a valuable contribution to the solution of the problem of running alternating current motors and generators in parallel. They refer to older theoretical investigations which are, however, of little value inasmuch as several of them contradict each other. *Elec. World*, March 30, '95; *Elektrotech. Zeitschrift*, April, 11 '95.

Early History of the Polyphase Motor. By Rankin Kennedy. The writer gives a short review of the history, and then gives Steinmetz's theory of the induction motor. *London Elec. Review*, April 5, '95.

The Tesla Two-Phase System. By Nelson W. Perry. Extensive use at the Westinghouse Works, Brinton. The new plant fully equipped with alternating current apparatus. Description of the works in *Electricity*, April 10, '95; continued April 17, '95.

Alternating and Interrupted Electric Currents. The first of a series of lectures delivered by Prof. George Forbes at the Royal Institution was principally devoted to a consideration of the effects of interrupted and alternating currents as distinguished from continuous currents. For abstract of paper see *London Elec. Review*, April 26, 95; *London Elec. Engineer*, May 3, '95.

Monocyclic Distribution of Steinmetz. A paper prepared from the American journals, by E. Boistel. *L'Eclairage Electrique*, April 27, '95.

Alternating Currents, its Generation and Distribution. By Prof. Geo. D. Shepardson. The sixth of the series of articles previously referred to treats principally with the magnets. *Elec. Industries*, May, '95.

The Constancy of the Rotary Magnetic Field. By Chas. T. Rittenhouse. See ELECTRIC POWER for March, Synopsis for June, and for German translation, *Elektrotech. Anzeiger*, May 19, '95.

Distribution of Electric Energy by Means of Polyphase Currents, in the laboratory of Weyher and Richemond. By A. Hess. Description with many views of the machinery. *L'Eclairage Electrique*, May 25, 95.

Elements of Alternating Current Principles. By George T. Hanchett. A simple demonstration of the very fundamental principles of alternating currents. ELECTRIC POWER, June, '95.

Electrolysis with Alternating Currents. By W. Peukert. It was shown by Dr. Frölich and also by Mr. Steinmetz that in the alternating current arc there is no change of phase. Writer tried to investigate whether he could observe the same in a voltameter if inserted in an alternating current. He also showed that a voltameter in an alternating current does not act like a self-inductive resistance, as has been supposed by some writers. *Elektrotech. Zeitschrift*, June 6, 95.

On the Causes Producing Phase Differences in Alternating Current Circuits. By Houston & Kennelly. The only quality which opposes the passage of a continuous electric current is the resistance of the circuit, the current in such circuit being entirely defined by Ohm's law. In an alternating-current circuit, beside the ohmic resistance there is also reactance, the combination of the resistance and the reactance of the circuit constituting what is called its impedance. The reactance of the circuit is always added to the resistance, but this addition is not made arithmetically but geometrically; that is to say, if resistance be represented by a straight horizontal line, the length of which stands for its numerical value, then reactance is also represented by a straight line at right angles to this.

As a practical example, the authors consider an alternating-current circuit consisting of:

1. A 60 K. W. alternator operated at 140 periods and 1,294 volts.
2. A pair of overhead conducting wires, each two miles long.
3. A 50 K. W. transformer at the receiving end.

Elec. World, June 8, '95.

Transmission of Energy by Three-Phase Currents with Double Transforming. By Julien Lefèvre. Although the use of multiphase currents is rather unexplored, there have already been a fair number of industrial applications of the system. The Compagnie de Fives-Lille has adopted three-phase currents for the transmission of energy. The dynamos producing these currents are not of any special design: They are of the same system as those of the Lauffen-Frankfort installation. They can be constructed for high-tension currents, but the company recommends rather the employment of low-tension machines, together with transformers. Thus the generator at the Lyons Exhibition gave 32,000 watts, at the speed of 750 revolutions a minute, with a frequency of 50 and a pressure of 120 volts between each principal conductor. The current thus produced is transformed up for transmission purposes, and reduced to low tension, on arrival, by a second transformer. As the transformers have a very high efficiency, the loss which results from this double transformation is insignificant. The transformers used consist of

three vertical coils, the iron cores of which are connected at each end by yokes. Their magnetic circuits are thus closed, although only having one bobbin for each current, for each core serves as a return to the lines of induction of the other two. These apparatus do not take up much floor space. In small types the two windings are superposed. From 60 kilowatts upwards each circuit is formed of coils in sections coupled in multiple for low tension, in series for high tension. The coils of the two windings alternate on the core and are carefully insulated by mica. The machine shown at Lyons was of 10 kilowatts, and designed to transform a pressure of 100 volts into one of 2,000 volts, and conversely. At the arrival station the three-phase currents, after being converted to 100 volts by the second transformer, can operate special motors. *L'Electricien*, June 8, '95; *London Elec. Engineer*, July 12, '95.

New Non-Synchronous Alternating Current Motor. By Dr. Gustav Benischke. The design is based on Prof. Elihu Thomson's experiments. The motor does not contain any iron. *Elektrotech. Zeitschrift*, June 13, '95.

The Output of Polyphase Generators and Rotary Transformers. By Ralph D. Mershon.

The factors relating to the output of polyphase generators and rotary transformers are mathematically treated and comparative deductions made.

It will be seen that the armature of any closed coil direct current machine may be simply transformed into a polyphased armature, it being merely necessary to make three or more connections corresponding to the desired number of phases, from collecting rings to the same number of commutator bars at an equal angular distance from each other. By merely changing the connections of a three-phased generator and adding three additional rings, the output of the machine may be increased 16 per cent. and a similar change in the connections of a three-phased rotary transformer will produce an increase of 45 per cent. in its output. Similarly, the output of what are called "quarter-phase" generators and rotary transformers are increased 10 and 22 per cent., respectively, over corresponding three-phased machines. It very often happens, however, that the factor which fixes the output of an armature is the heating limit, and in the present instance it might occur that the calculated gain cannot therefore be practically realized, though, in any case, on account of the increased efficiency of the armature, it may be approached. *Elec. World*, June 15, '95.

The Testing of Alternating Current Dynamos. Dr. Behn-Eschenberg, of the Oerlikon Works describes a method of testing alternating current dynamos, which is claimed to give direct values suitable for an exact comparison of the various factors entering into the efficiency of alternators. The method appears to be simple; the principles of the method are in line with those involved in Mr. Kapp's tests for transformers, and these two contributions to the practical side of alternating work go far toward putting this branch on a plane with direct current practice with respect to ease and determining the necessary efficiency data. *Elec. World*, June 22, '95.

Rotary Current and Alternating Current Dynamos of the Allgemeine Elektrizitaets Gesellschaft. By Dolivo Dobrowolsky. Paper read before the Elektrotech. Verein, describing new types of machinery and referring to self-induction and armature reaction. *London Elec. Engineer*, June 28, '95.

Some Features of the Alternating Current Systems. By Chas. Proteus Steinmetz. Paper read before the Am. Inst. of Elec. Engineers, June 26–28, '95.

Author gives a review of the work done in the last years with respect to alternating current. The cause of unbalancing of polyphase systems is explained as due to the fact that as the field excitation of a polyphase generator cannot be adjusted to varying loads in the several circuits fed by it, the distribution of voltage in such circuits will vary with the loads, thus rendering lighting from them unsatisfactory. It is declared futile to attempt to derive a polyphase system from a simple alternating current for the reason that a source for the storage of energy is thereby required, which is impracticable. As a single alternating current passes through zero at every alternation, if such a current is split, one branch must be supplied with a storage source so that that current will be stored and given out, while the other is passing through zero. Electromagnetic and electrostatic means of storage for this purpose are excluded in most cases by low energy efficiency and especially low weight efficiency and inconvenience.

Excluding storage of energy, it is claimed that the nature of the flow of energy constitutes an essential feature of an alternating-current system. It is proposed that an alternating-current system of constant flow of energy be called a balanced system and "balance factors" applied to other systems, the factor denoting the ratio of the minimum value to the mean value of energy flow. Preference is expressed for the name of "polycyclic" for polyphase systems, and "monocyclic" for a system with only one wave of energy.

It is added that from another point of view the importance should be recognized of the flow of energy as a characteristic of an alternating-current circuit. While in a continuous-current circuit the direction of transmission is in the direction of decreasing voltage, in an alternating current circuit with capacity, it may be from a lower to a higher voltage.

The remainder of the paper deals with the principles of alternating motors, and the property of self-regulation of balance of polyphase generators and motors when working near maximum output. *Elec. World*, July 6, '95; *Elec. Engineer*, July 10, '95; ELECTRIC POWER, July, '95.

Some Observations on a Direct Connected 300 K. W. Monocyclic Alternator. By Dugald C. Jackson and S. B. Fortenbaugh. Paper read before the Am. Inst. of Elec. Engineers, June 26, '95. A new machine, 1,150 volts, 260 amperes, 140 revolutions per minute, was experimented on. The commercial efficiency of the generator set is about 81 per cent. The commercial efficiency is taken as the ratio of the electrical output to the indicated horse-power. For the ordinary changes of load, the regulation of the alternator is not en-

tirely effected by the series coils of the machine, but requires considerable hand regulation. *Western Electrician*, July 20, '95 ; *Elec. Engineer*, July 3, '95.

Study of the Magnetic Field of a Two-Phase Motor. By S. Hanappe. A careful description of a five H. P. motor of the Brown type, and a complete set of experiments with results obtained given in tables and curves. *L'Eclairage Electrique*, July 6, '95, and continued in subsequent issues.

Alternating Current Curves. By Charles E. Emery, Ph. D. Paper read before the Am. Inst. of Elec. Engineers, June 27, '95.

Instead of the sine curve it is proposed to substitute a purely empirical curve, expressed by the simple algebraic function $y = a x^b$ in which a is a constant and b an arbitrary partial exponent for particular series of solutions. By means of this equation, it was stated that curves may be obtained to represent any form of alternating-current curve even though they be symmetrical, exception being made in the case of a curve having a point of inflection. *Elec. World*, July 6, '95 ; *Elec. Engineer*, July 24, '95.

Induction Motors. By Chas. Proteus Steinmetz. Author answers the following questions: 1. What makes an induction motor go? 2. What determines the speed on an induction motor of any given frequency? 3. What determines the running torque? 4. What determines the starting torque? 5. How would you go to work to design an induction motor to fill any given condition? ELECTRIC POWER, August, '95.

On the Influence of the Form of the E. M. F. on the Idle Currents in Alternating Current Transformers. By C. P. Feldmann. Writer shows results obtained by means of graphical methods. He seems to agree with Mr. Steinmetz that a pointed curve is preferable to a perfect sine curve. *Elektrotechn. Zeitschrift*, Aug. 1, '95.

Armature Reaction in Polyphase Dynamos. By Désiré Korda. While in the ordinary alternator, which is fed by a continuous current, the currents produced in the armature react on the direct current of the generator inductively, and in that way cause undulations in the field, in polyphase generators, such variations will not occur. This the writer proves mathematically in *Elektrotechn. Zeitschrift*, Aug. 8, '95.

Determination of the E. M. F. of Alternators. By R. P. Brouson. The method adopted consists in basing the calculation of E. M. F. on the same simple formula used in continuous current design, with the introduction of a factor to account for the differences between the action of the two types of machines. This, of course, is the usual method, but the value of Mr. Brouson's article lies in discussion of the constant referred to above. This constant has sometimes been given as a deduction from the form of the curve of E. M. F. generated, while, as explained, it depends solely upon the configuration of the magnet poles and armature coils, and can only be determined by a method taking these factors into consideration, or experimentally. *Elec. World*, Aug. 30, '95.

Alternating Currents. By Louis Bell, Ph.D. Paper read at Cooper Union in connection with Columbia College University Extension. A popular discussion of the subject. ELECTRIC POWER, September, '95.

Choice of Transformers. By D. C. Jackson. Paper read before the Northwestern Electrical Association, July 17, '95. After giving results obtained on nine different transformers, the author adds the values of the iron losses which should not be exceeded in thoroughly good transformers.

Watt Capacity.	Iron losses.	Watt Capacity.	Iron Losses.
1000	30	4000	80
1500	40	6500	100
2000	50	17,500	150
2500	60		

The copper losses in transformers of all sizes should never exceed three and one-half per cent at full load, and ought to be between one and one-half and two and one-half per cent. The total drop in secondary pressure, due to loading a transformer, if the primary pressure is kept constant, ought not to exceed three and a half per cent. *Elec. Review*, Sept. 4, '95 ; *Electricity*, Sept. 4, '95.

Regulation of Alternating Dynamos. By W. L. R. Emmet. Writer mentions causes of error in a direct current machine as being: (1) variations of pressure at dynamo terminals due to armature reaction and resistance ; (2) variations due to resistances of lines ; he then mentions the additional difficulties in alternating current work and explains how to deal with those in the design of the machine. He finally discusses the regulation of alternators which are built on different principles which are renumerated. ELECTRIC POWER, October, '95 ; *London Elec. Engineer*, Oct. 18, '95.

Phasing Transformers. By Chas. S. Bradley. Abstract of a paper read before the American Institute of Electrical Engineers, Sept. 25, '95.

One of the important links to round out the art seems to be the phasing transformer, so that we can take a single phase alternating current and convert it into polyphase of any desired number.

The author gives a full description of his arrangements of condensers and inductances, which he finds will keep the phases at a working relation. *London Elec. Engineer*, Oct. 18, '95 ; *Elec. Rev.*, Oct. 2, '95 ; *Electricity*, Oct. 2, '95.

Influence of the Shape of the E. M. F. Curve upon the Iron Losses of Alternating Current Transformers. By Clarence P. Feldmann. The step from the legendary ground of the pure sine curve to the real shape of the E M. F. curve introduces complications, but allows conclusions upon the real working conditions of a transformer. Author has found a graphical method of showing the differences between the iron losses for peaked and flat curves of E. M. F.

When trying to introduce the real shape of the E. M. F., the first difficulty is offered by the fact that not only the E. M. F. but also the curve of magnetism contains wrinkles due to the existence of the higher harmonics. The iron is thus carried through hysteresis cy-

cles with loops, and as these loops are passed with 3, 5, . . . times the velocity as the main cycle, they must obviously change their position with regard to the main cycle.

This difficulty is overcome as soon as not only the curve of E. M F., but also that of the corresponding magnetism, is resolved into its components. Worked out in detail in *London Electrician*, Oct. 8, '95.

Magnetic Leakage in Rotary Field Motors. By A. Blondel. The first of a series of articles, containing a theoretical discussion of the subject. *L'Eclairage Electrique*, Oct. 19, '95, and subsequent issues.

The Behavior of Transformers under the Influence of Alternating Currents of different Wave Forms. By Dr. G. Roessler. Paper read before the Verband Deutscher Elektrotechniker, Munich, July 6, '95. While by some it is considered advisable in the building of an alternator to endeavor to obtain a sine variation of the E. M. F., others consider this possibly detrimental. In face of these differences of opinion, it seemed right to the author that he should bring out a series of investigations. The description of the investigations and tabulation of their results is followed by a theoretical explanation which extends the results of the measurements to a general theory of the transformer under the influence of current of different wave forms. *London Electrician*, Nov. 22, '95.

To the Theory of the Non-Synchronous Alternating Current Motor. By Hans Görges. Author studies the phenomena by starting with the resultant magnetic field. The polyphase motor appears to the author as a special case of the single phase motor. *Elektrotechn. Zeitschrift*, Nov. 28, '95, and continued in subsequent issues.

Loss of Energy in Changing from a Single Alternating Current to Polyphase Current. If we transform a single alternating current into a polyphase current, we must have means of storing up some of the energy during one part of the phase, so as to deliver it to the circuit during the remainder. Writer shows that the amount of energy so stored up is a considerable fraction of the whole work of the circuit, and therefore the means for storing up should be efficient. The method where condensers are used seems to be inefficient, and therefore the writer proposes to have a device in which the power is stored up in the momentum of the armature itself. *Elec. World*, Dec. 7, '95.

Frequency Changing and Single Phase Alternating Current Motor Transformer. By Lieut. F. Jarvis Patten. Writer gives his latest experiments, practically the continuation of the work, presented by the author to the American Institute of Electrical Engineers in February, 1892. *Elec. World*, Dec. 21, '95.

Loss of Revenue Due to Transformer Leakage Current. By Spring S. Armstrong. Comparison of various tests and the suggestion to use the largest transformers possible in the particular service. *Elec. Engineer*, Dec. 25, '95.

BIOGRAPHICAL.

George H. Roe, President of the Edison Light and Power Company, San Francisco. Obituary with portrait. *Pacific Electrician*, Dec., '94.

Ex-Governor Oden Bowie. Obituary and biographical sketch. *St. R'y Gazette*, Dec. 15, '94.

Biographies of the following gentlemen :—Frank Jaynes ; Frank H. Lamb, and James D. Hage are to be found in *Telegraph Age*, Dec. 16, '94.

Sir Wm. Arrol. *Engineering Review* (London), Dec. 20, '94.

Elliott P. Gleason. A pioneer lighting manufacturer. *Elec. Engineer*, Dec. 26, '94.

Gisbert Kapp. A review of his life, with portrait. *Elec. World*, Dec. 29, '94.

Necrology, 1894. A short review of the lives of the prominent men in science who died during 1894: Jablochkoff, Hertz, Richardson, Julien, Helmholtz, and others. *Elec. Ind.*, Jan., '95.

Biographies and Portraits of the following gentlemen :—Dr. R. J. Gatling ; Gen. Wm. F. Draper ; Sylvanus D. Locke ; Geo. W. Bierce ; Henry Martin Boies, and Thos. D. Lockwood are to be found in *Inventive Age*, Jan., '95.

Edward Millar Gard Eddy. A biography, with portrait. *Engineering Review*, London, Jan., '95.

James Deas. A biography, with portrait. *Engineering Review*, London, Jan., '95.

Ludwig Boltzmann. A biography written by M. I. Pupin, Ph. D. *Elec. World*, Jan. 5, '95.

Kohlrausch, Dr. Frederick, Professor of Physics at Strasburg, has been appointed successor to Prof. Helmholtz. His biography is therefore of considerable interest, and is given in *Electricity*, Jan. 9, '95.

James U. MacKenzie. By W. J. Hammer. An obituary with a review of his life. *Elec. Engineer*, Jan. 16, '95.

Rudolf Eickemeyer. Obituary. *Elec. Engineer*, Jan. 30, '95 ; ELECTRIC POWER, Feb., '95 ; *Elec. Review*, Jan. 30, '95.

Augustus Noll. A biography, with portrait. *Elec. Engineer*, Feb. 6. '95.

Reminiscences of the late Rudolf Eickemeyer. By David E. Lain, with portrait. *Elec. Engineer*, Feb. 13, '95.

Gustavus Swan. The most remarkable telegrapher in America. *Telegraph Age*, Feb. 16.

Eugene L. Maxwell. An obituary, with portrait of the deceased. *The Foundry*, March, '95.

Prof. Arthur Cayley, F.R.S. Obituary. The eminent mathematician of Cambridge, England, died January 26, in his 74th year. *Am. Journal of Science*, March, '95

Reminiscences of the late Rudolf Eickemeyer. By Stephen D. Field. *Elec. Engineer*, March 6, '95.

C. H. Wilmerding. President of the National Electric Light Association; with portrait. *Western Electrician*, March 6, '95.

Royal E. House and the Early Telegraph. By Franklin Leonard Pope. A review of House's life, with a portrait of the deceased. *Electrical Engineer*, March 6, 95.

Rudolf Eickemeyer. By Chas. Proteus Steinmetz. A few notes on his long and useful life,with a portrait. *Electrical World*, March 16, '95.

Benjamin Alfred Dobson. A biography, with portrait. *The Engineering Review*, (London,) March 20, '95.

Prof. P. H. Van der Weyde. Obituary in *Elec. World*, March 30, '95.

Some Features of the Inventive Career of Hiram S. Maxim. By J. Bucknall Smith. With 22 illustrations of Maxim's home, his several machine guns, his flying machine and its machinery, the early Maxim electro-incandescent lamp, the great Maxim-Nordenfeldt gun works, etc. *Cassier's Magazine*, April, '95.

Frederick E. Sickels. Inventor. A review of his life and work. With portrait. *Am. Machinist*, April 4, '95.

Oscar Zollikoffer. Obituary in *Am. Gas Light Journal*, April 15, '95; *Progressive Age*, April 15, '95.

George May Phelps. Obituary in *St. R'y Gazette*, April 13, '95; *Electricity*, April 17, '95; *Elec. Review*, April 17, '95; *Elec. Engineer*, April 17, '95; *Elec. World*, April 20, '95.

Charles Augustin de Coulomb. By Alfred M. Mayer. A short statement of Coulomb's works and a portrait which was sketched from a bust of Coulomb in the Conservatoire des Arts et Métiers, in Paris. *Elec. Engineer*, April 24, '95.

James D. Dana. Obituary with portrait in *Scientific American*, April 27, '95.

Death of William J. Richardson. A review of his life, with portrait. *Electricity*, May 1, '95; *Elec. Review*, May 1, '95.

Alexander Graham Bell. Biographical sketch with portrait. *Cassier's Magazine*, May, '95.

Professor Jules François Joubert. By André Blondel. A biography with portrait. *Elec. World*, May 4, '95.

William Henry Preece. By Herbert Laws Webb. A character sketch with portrait. ELECTRIC POWER, June, '95.

Lord Kelvin. The July number of *Pall Mall Gazette* contains an appreciative article on Lord Kelvin, by Mr. Arthur Warren, from which portrait and paragraphs are reproduced relating more particularly to the personal history and traits of the great scientist. *Elec. World*, June 29, '95.

Joseph Barker Stearns. Obituary with portrait. *Elec. Engineer*, July 10, '95.

Editors of Electrical Journals. By Harold McGill Davis. Biographies of Messrs. Chas. W. Price, Stephen L. Coles. N. W. Perry, B. E. Greene and R. H. Willoughby. ELECTRIC POWER, August, '95.

Prof. Geo. D. Shepardson. A biography with portrait. *Western Electrician*, Aug. 24, '95.

Editors of Electrical Journals. By Harold McGill Davis. Biographies of Messrs. Taltavall and Harrison. ELECTRIC POWER, September, '95.

Prof. W. M. Stine and his Work at Armour Institute. With portrait. *Western Electrician*, Sept. 7, '95

William Sturgeon. A biography contributed by W. W. Haldeme Gee to the *London Electrician*, Sept. 13, '95.

Death of Henry Bentley. Father of the local telegraph. Obituary with portrait. *Elec. Review*, Sept. 18, '95.

Ohm Statue at Munich. On July 5, during the third annual meeting of the Verband Deutscher Elektro-techniker, at Munich, a statue of Ohm was unveiled in front of the Technical High School. For details see *Elec. Engineer*, Sept. 18, '95.

Some of the Leading British Authors in the Electrical Field. The biographies with portraits of the following gentlemen: Lord Kelvin, W. H. Preece, James Swinburne, H. R. Kenyse, S. P. Thompson, O. J. Lodge, W. P. Maycock, Prof. R. M. Walmsley, Sir D. Salomons, Prof. W. E. Ayrton, A. T. Suell, G. Kapp, J. A. Fleming, A. Jamieson, A. Brooker, W. Slingo. *London Electricity*, Oct. 4, '95.

Sigmund Schuckert. Obituary in *Electrotechnischer Anzeiger*, Oct. 6, '95; *Elec. World*, Oct. 26, '95.

Franklin Leonard Pope. Obituary, accompanied by a description how the deceased lost his life by coming in contact with a live wire. *Electricity*, Oct. 23, '95; *Elec. Review*, Oct. 23, '95; *Elec. World*, Oct. 26, '95; *Western Electrician*, Oct. 26, '95.

Frank J. Sprague. Portrait; also short biography, with a note on Mr. Sprague's present views of the railway problem. ELECTRIC POWER, November, '95.

Franklin Leonard Pope. Obituary with portrait. ELECTRIC POWER, December, '95.

CENTRAL STATIONS.

Central Station Types. By Geo. White Fraser. After a short discussion of municipal *vs.* private ownership of electric lighting plants, a small municipal plant in Orillia is described. The capacity of the plant is 2,000 16 C. P. incandescent lamps and 40 2,000 C. P. arcs. The operating expenses are $4,165. *Can. Elec. News*, Jan., '95.

The Electrical Station of Argues-la-Bataille. By J. A. Montpellier. A municipal lighting plant fully described and illustrated, the principal feature being a turbine. *L'Electricien*, Jan. 5, '95.

The Frankfort, Germany, Municipal Electric Light Station. By Dr. R. Haas, M. A. After a short introduction the writer discusses the Central Station, Underground System and Transformers. The article is illustrated, showing transformer pit, oil insulated transformers, etc. *Elec. Engineer*, Jan. 9, '95.

The Development of Municipal Plants for Light and Power. By Max Meyer, (Nuremberg, Bavaria). Statistics prepared by the writer of the above paper shows a profit in per cent. of the capital invested of from 6.98 to 14.96 in the years 1893–94. *Elektro. Zeitschrift*, Jan. 10, '95.

The Chicago Edison Company. Its history and work. By T. C. Martin. An 18 page article, giving an complete description of this mammoth plant, with illustrations, sectional views, plans, etc., of every essential part of the plant. *Elec. Engineer*, Jan. 23, '95.

Frankfort on the Main Municipal Light and Power Plant. By C. J. Melins. Illustrated description in *Elec. World*, Jan. 26, '95.

The Municipal Lighting Plant of South Norwalk, Conn. Description and statistics of plant. During the last year the average cost per lamp, interest and depreciation included, was 59.29\frac{3}{10}$. The plant consists of 120 arc lamps. *Elec. Engineer*, Jan. 30, '95.

The Electricity Works at Yarmouth. A municipal electric lighting plant, high pressure alternating current generator with transformer stations for incandescent lighting, and direct current series machines for street illumination by means of arc lamps. A very full account with a number of diagrams and illustrations. *London Elec. Engineer*, Jan. 11, '95 ; abstract in *Elec. Engineer*, Jan. 30, '95,

Municipal Plant Statistics. By Horatio A. Foster. Refers to and comments on a report of the city plant of South Norwalk, Conn. ELECTRIC POWER, Feb., '95.

A Model Arc Lighting Plant, recently installed by the Mutual Electric Light and Power Co. of Chicago. Description, with many illustrations. *Elec. Industries*, Feb., '95.

Three Central Electric Light Works. A full description, with good illustrations, of three new municipal plants at Halifax, Nottingham and Drewsbury. *Elec. Review*, London, Feb. 1, '95.

The Eddy Street Power Station at Providence, R. I. By Geo. T. Hanchett. Three dynamos, capable of generating 910 amperes at 550 volts; one direct connected 750 K.W. dynamo, and finally one of the generators which was used for the intramural railroad at Chicago, form the electrical part of the station. *Elec. World*, Feb. 2, '95.

Electric Lighting in Mexico. The plant of the Agnas Calientes Electric Light Company. By Geo. Heli Guy. Illustrated description of plant. *Elec. Engineer*, Feb. 6, '95.

Borough of Wolverhampton Electricity Works. Illustrated description of a municipal plant. *Lighting*, Feb. 7, '95.

The Municipal Light and Power Plant at Bremen. Described by F. Jordan. The works are laid out on the three wire system, comprises four stations, one principal station with boiler and machinery, and three accumulator, booster and regulating apparatus sub-stations. One of the characteristics of the plant is that the two wire system is used between main and sub-stations, and the three wire distribution only starts at the sub-stations. A number of good illustrations add to the interest of the article. *Elektrotechn. Zeitschr.*, Feb. 7, '95.

Direct Connected Arc Lighting Station. The plant is located at Eighty-ninth and Loomis Streets, Chicago. It includes at present three 125 arc dynamos (Brush), connected direct to three Willans high speed engines. The interior of the dynamo room is illustrated, and the whole plant described in detail in *Elec. World*, Feb. 9, '95.

The Electricity Works at Blackburn. A municipal lighting plant. Among the rules for installation work it is mentioned that in an installation of 25 lights, the insulation resistance must be two megohms. *London Elec. Engineer*, Feb. 15, '95.

The New Plant of the Cleveland Electric Illuminating Co. Complete description with plan of station. *Elec. Engineer*, Feb. 20, '95.

The Blackburn Electricity Supply Works. Description of plant. *London Elec. Review*, March 1, '95.

Fuel Consumption in Central Stations. The Committee on Data of the National Elec. Light Association, submitted at the Cleveland Convention a tabulated report of the data relating to fuel consumption. This report is reprinted in *Elec. World*, March 2, '95.

The Storage of Energy essential to the Economy of Working Stations. By Nelson W. Perry. This paper does not allow of a *short* abstract, as it is full of interesting tables and calculations. *Elec. World*, March 2, '95; *Western Elec.*, March 9, '95; *Electricity*, March 13, '95.

Lancaster Corporation Electric Works. Description of Municipal plant. *Lightning*, March 14, '95.

Logansport Municipal Lighting Plant, Combining Water and Steam Power. By Carl Kammeyer. Logansport, Ind., was paying a local lighting company $10,000 per annum for 100 street lights of 2,000 candle-power, operated upon the moonlight schedule. They have now put in their own plant which seems to be, judging from the short time, a great success. *Elec. Engineer*, March 27, '95.

Electricity Works at Salzungen. Although a small station, it appears to be a typical German plant, where storage batteries play an important part. *Elektrotech. Zeitschrift*, April 4, '95.

Belfast Corporation Electricity Works. The specifications for this plant were drawn by Prof. Kennedy. An itemized account of the probable running expenses is given in *Lightning*, April 4, '95.

New Power Station in Newark of the Consolidated Traction Company. Illustrated description of plant. *Street R'y Gazette*, April 6, '95.

Sunderland Corporation Electricity Works. The point of special interest in the works described and illustrated in this article is the method of distribution adopted. In Sunderland there is, in the business part of the town near the site of the station, a compact area which can well be served by low-tension direct current on the three-wire system, but away to the south west on the remote side of the park is a wealthy scattered residential district which must be reached by high tension if it is to be worked at all to a profit. Low-tension service is nearly always by direct current, while for long-distance transmission the alternating system holds the field, both from the greater facility of generation at high pressure and because of the ease of transformation. To secure this double advantage the direct current, generated at low pressure, will be used to drive motor-alternators, the alternating current from which can be transmitted at high pressure to the outlying residential districts. This part of the scheme is at present in abeyance until the central lighting shall have been well started, but there is little doubt that it will ultimately be carried out in its entirety. *Lightning*, April 11, '95.

A Modern Electric Light Station. Illustrated description of the First District station of the Edison Company in Pearl Street, Brooklyn. Especial mention should be made of the illustration and description of a large booster dynamo. *Elec. World*, April 13, 95.

Citizens' Electric Illuminating Company's Plant in Brooklyn. An illustrated description of an interesting modern plant. *Elec. Review*, April 17, '95; *Elec. Engineer*, April 17, '95.

New Lights in Old Edinburgh. A description of the opening of the new electric light works. *Lightning*, April 18, '95.

New Station of the Brush Electric Company, Baltimore. The equipment of the station is of the most modern type. It is arranged for four two-phase Westinghouse alternators, each having a capacity of 15,000 sixteen candle-power lights. The generators are direct coupled to the engines. Complete description is given in *Elec. Engineer*, April 24, '95.

Working Out its Own Salvation. By Nelson W. Perry. The writer shows that the only solution for a successful central station is in the establishing of an even load line as near the maximum output of the station as possible. He proposes a number of methods of applying the current for electro-chemical or electro-metallurgical manufacture, in order to prevent the machines from standing idle. ELECTRIC POWER, April, '95. Continued May, '95.

New Methods in Central Stations at Belfast and Leicester. In Belfast gas engines have been adopted, being the largest installation of gas engines in the World. A 200 volt system is used and distributed on the three-wire method, in conjunction with a set of accumulators. *London Elec. Review*, April 26, '95.

An English Municipal Lighting Plant. An interesting example afforded in Manchester, England. The plant installed by the city in 1893 is low tension on the five-wire system, and cost in all $803,120. This is made up as follows:

Real estate	$219,417.
Buildings	117,967.
Steam and electric plant	174,273.
Mains and cables in streets (total of 61 miles)	237,764.
Electrical instruments	3,611.
Meters	29,268.
Consulting engineer	20,825.
Total	$803,120.

Elec. Review, May 8, '95.

The Chemnitz Central Station. A station in which the three-phase system has been adopted. Described in *London Elec. Review*, May 10, '95.

Points of Interest in the Development of Electricity Supply at Brighton. By Arthur Wright, Electrical Engineer, Brighton Electricity Works. Perhaps the title the author has chosen may, at first sight, appear to assume too much, but he trusts he will be able to interest the majority of the members by acquainting them with certain facts connected with the gradual development of electricity supply in Brighton, especially when he states that, as far as he has been able to determine, Brighton was the first town in England (1) to possess a central station erected for the express purpose of supplying the general public with electricity; (2) in which the inhabitants had the opportunity of paying for the electricity they actually consumed; (3) to have the advantage, or the reverse, of having had electricity supplied by more than four distinct systems of electric distribution during the last ten years; (4) to have been the first town to adopt a differential system of charging for the electricity consumed, based on the actual cost of supplying it to each individual customer; (5) in which electricity has been supplied from one central station, both by the continuous and alternating systems of distribution simultaneously. *London Elec. Engineer*, May 10, '95.

The Three-Phase Plant of the Vermont Electric Company at Winooski, Vt. Electrical equipment consists of a Westinghouse generator, rated at 46 amperes at 2,500 volts, running at 450 revolu-

tions per minute and having a periodicity of 7,200 alternations. *Elec. Engineer*, May 15, '95.

Electricity Works of the Budapest General Electric Stock Company. By Prof. Dr. Kittler. A valuable contribution to central station practice. *Elektrotech. Zeitschrift*, May 16, '95.

Electric Lighting at Hong Kong. Three arc light dynamos of 55 lights capacity are run off a counter shaft by belts. The alternators are 50 kilowatts, with 75 periods and 2,000 volts. *London Elec. Review*, May 31, '95.

Cheltenham Electric Lighting. Although the electric lighting of Cheltenham does not constitute any great departure from general practice, some of the details of the system are interesting. The plant is described in *London Elec. Review*, May 31, '95.

A Modern English Central Station. Leicester, England, is one of the latest English municipalities to establish an electric light plant. A description of same is given in *Elec. World*, June 1, '95.

Electric Lighting Station at Davos, Switzerland. Water power is utilized, the water being conveyed to the turbines along about 2,000 metres of piping. Turbines work under a head of 328 feet, and are provided with automatic regulating apparatus. Dynamos give 3,360 volts and 40 amperes; number of cycles is 53. *Industries and Iron*, June 7, '95.

A Combination Alternating and Direct Current Plant. In order to keep down the weight of copper in the conductors connecting the central station with the district where current was to be consumed, and to simplify the generating apparatus, it was decided to generate high-tension alternating currents at a voltage of 1,800, at the primary station, and transform to continuous current of low voltage at a sub-station in the consuming district, by means of rotary transformers, consisting of alternating-current motors coupled to continuous-current dynamos. The two phase system was adopted for the primary end. At the sub-station, continuous-current dynamos, direct-driven by two-phase motors, deliver current directly to the distributing net-work, and also supply current to charge a battery of accumulators in this station. For detailed description, including a number of illustrations, see *Elec. World*, June 8, '95.

Coal Consumption in an Edison Station, Type of 1890. An abstract of a paper, read by R. S. Hale. *Elec. Engineer*, June 12, '95.

Municipal Water Works and Electric Light Plant of North Attleboro, Mass. This plant combines water with electricity, and uses incandescent instead of arc lighting for the streets. The steam plant consists of one 175 H. P. and one 100 H. P. engine and a 250 H. P. boiler. Alternating current is used. Detailed description is given in *Elec. Engineer*, June 26, '95.

Oldham Corporation Electric Supply Station. A municipal plant described and illustrated in London *Lightning*, June 27, '95.

Central Station of the People's Electric Light and Motor Power Company. Description of plant with various views appeared in *Elec. Industries*, July, '95.

Belfast, Ireland, Municipal Electric Station. Article taken from London *Lightning*, April 4, '95, and referred to in Synopsis for July. *Elec. Review*, July 3, '95.

Tests of a Combined Electric Light and Railway Central Station. By D. C. Jackson and Arthur W. Richter. Paper read before the Am. Soc. of Mech. Engineers, June, '95. The principal results of the tests are shown graphically. *Elec. Review*, July 3, '95.

Central Station at Nancy. Description of station taken from an article by M. Laffargue, in *L'Industrie Electrique*, is copied in *London Elec. Review*, July 12, '95.

Notes on the Reconstruction of a small Central Station. By Franklin L. Pope. Paper read before the Am. Inst. of Elec. Engineers, June 27, '95.

The plant forming the subject of the paper is located at Great Barrington, Mass., and consisted of two 250-light three-wire incandescent machines, a 35-arc machine and an 80 K. W. alternator, steam power being used. The plant was not profitable, and recently the machinery was discarded and current brought from a water-power electric plant located 5.15 miles distant, the latter consisting of a two-phase generator run by a turbine. The transmission line is bare copper, except along highways; the poles are extra heavy, and the line is supported on double-bell white porcelain insulators, one on each pole, being carried by a 14-inch iron stem on the top of the pole and the other by an iron goose-neck. In the village two distributing centres were fixed upon it in the old Edison network and a pair of large transformers there installed. One hundred and twenty-six 32 C. P. incandescent lamps were substituted for the thirty-five 1,500 C. P. arcs that had been in use, and the old transformers on the Westinghouse system were used with some changes in the distribution connections, though the voltage of the new system was 2,100 volts and the frequency 60, instead of 1,050 and 133, respectively, for which the transformers were designed. At present only one side of the two-phase system is used, but it is proposed to run a third wire and install induction motors. The change is pronounced satisfactory in every respect, the financial returns being satisfactory and the incandescent street lamps considered superior to the former arcs. The conclusions of the paper are that similarly it is possible to largely increase the net earnings of a plant without refitting it throughout, but that in the selection of a water-power and turbine great care should be exercised to see that the former is sufficient at all seasons and the latter has a high efficiency. The use in small towns and cities of incandescent lamps of from 24 to 32 C. P. for street lighting, and the employment of large transformers generally, are recommended. A cross-country transmission line is considered preferable, and the use of iron pin and goose-neck supports for insulators advised. High voltage is recommended on account of the better results in distribution. *Electricity*, July 3, '95;

Elec. World, July 6, '95 ; *Elec. Review*, July 10, '95 ; *Elec. Engineer*, July 17, '95 ; *Western Electrician*, Aug. 24, '95.

Central Station Economies. By J. S. Stephens. Paper read before the Northwestern Elec. Ass'n, July 17, '95. We have to consider relative location of plant to centers of distribution, proximity to water and fuel supply, cost of property and possibilities of future combination of light and power supply ; use of exhaust steam for heating in winter ; in many cases a possible combination of factory power. *Western Electrician*, Aug. 3, '95 ; *Elec. Review*, July 31, '95.

Municipal Lighting Plant at Hawarden, Iowa. Cost of plant aside from real estate was $12,000. Electrical equipment consists of a 36 kilowatt T. H. alternator ; distribution is on the basis of 1,000 volts pressure. *Western Electrician*, Aug. 10, '95.

Edinburgh Corporation Electricity Works. A combined system has been adopted of high tension alternating, with Ferranti rectifiers for arc lighting, and a low tension three-wire system. A full description of this plant appeared in *London Elec. Review*, Aug. 16, '95.

Ferranti Rectifier in the Edinburgh Central Station. Illustrated description of a Ferranti Rectifier for arc lights from an alternating current circuit. *Elec. Review*, Sept. 4, '95.

Aberdeen Electricity Works. Complete description of the plant, including a map showing the streets with feeding points. *London Elec. Engineer*. Sept. 6, '95.

Stafford Electricity Works. The following shows round figures at which various companies took the contract for this new municipal plant :

Foundations, etc	£1,837
Boilers, including boiler-feed pumps, economizers and steam-pipes	2,198
Engines, including steam-pipes in engine-house and pumps for condensing	2,420
Dynamos	1,151
Switchboards	505
Mains	1,290
Traveller	185
Buildings	3,030
Iron work for roof	197
Water-softener	220
Accumulators	882
Exhaust-pipes	75
Overhead tank for condensing purposes	117

A very complete description of the plant with many line drawings were published in *London Elec. Engineer*, Oct, 11, '95.

Arnold's Power Station System at Fort Dodge, Iowa. Description of the manner in which the machinery is installed. *Western Electrician*, Oct. 12, '95.

Lighting of the City of Hamilton, Ohio. A complete description of a municipal plant, with plan of city, showing location of arc lamps. *Elec. Industries*, Dec., '95.

Street Railway and Electricity Works at Altenburg. A short description of a combined railway and lighting station. The same

dynamos are used for lighting and railway work; in the latter case the dynamos are connected in series, in the first in shunt *Die Elektrizität*, Dec. 7, '95.

Walsall Electricity Works. Description of plant, with plan views sections and elevations. *London Elec. Engineer*, Dec. 20, '95.

DYNAMOS AND MOTORS.

Direct Current Motor and Dynamo Design. A lecture delivered before the N. Y. Electrical Society, Nov. 27, 1894, by Gano. S. Dunn. The writer of the paper selected a few particular points which he treated in such admirable manner that anything but the paper in full would be doing injustice to the author ; it is a paper highly to be recommended to the engineer, the artisan and the practical man. The paper is reprinted in full in *Elec. Review*, Dec. 12; *Elec. Engineer*, Dec. 12; *Electricity*, Dec. 12, '94; *Power*, Jan., '95.

New Construction of Dynamos Without Iron. By Prof. Pietzker. Read before the "Elektrischen Verein." A theoretical deduction of an entirely new form of dynamos. *Elektr. Zeitschr.*, Dec. 20, '94.

Application of Electric Motors in the Household. A review of the possibilities of the motor for household work. *Sciences et Commerce* (Paris), Dec. 20, '94.

Sparking of Closed Coil Dynamo. By George T. Hanchett. A complete set of possible causes, with suggestions for a remedy in each case. *Elec. World*, Dec. 29, '94.

Motor Repairs. The third of a series of articles by James F. Hobart. This section treats principally with the handling of armatures. *St. R'y Journal*, Jan., '95.

Methods of Determining the Efficiency of Dynamos and Motors. By J. Reginald Ashworth. The continuation of a series of articles. The present section describes the simple prony brake, the absorption ergometers, and the balance method. *Elec. Plant and Ind.*, Jan. 1, '95.

Practical Notes on Dynamo Calculations. By Alfred E. Wiener. A part of synopsis to previous articles. *Elec. World*, Jan. 5, '95.

Electrodynamic Machinery. By E. J. Houston and A. E. Kennelly. The XXI. of a series of articles contains a synopsis of the preceding sections. *Elec. World*, Jan. 5, '95.

Theory of the Synchronous Motor. By Chas. P. Steinmetz. A purely theoretical deduction of a single-phase circuit. *Elektrotech. Zeitschrift*, Jan. 10., '95.

Constant Speed Motors. By Thos. J. Fay. A series of experiments giving the variations of speed of shunt wound motors. The writer draws the following conclusions : We might say for shunt motors in general, that the fields should be so proportioned as not to heat very much above the temperature of the surrounding air, then the change in speed between zero load hot and zero load cold would be a minimum, and the resistance in ohms of the armature should be as low as possible. *Elec. Age*, Jan. 19, '95.

A Test of a Sixty-five Horse-Power Motor. By Thos. J. Fay. A diagram accompanies the article which commends itself for the facility of showing, (*a*) The loss in the motor running free; (*b*) The loss in shafting and machinery (doing no useful work); (*c*) The useful work; (*d*) The loss in transmission. *Elec. Age*, Feb. 2, '95.

Hints upon Daily Work about a Dynamo Plant. By Pliny Norcross. Read before the Northwestern Elec. Assoc., Jan. 16, '95. A compilation of practical suggestions, all more or less well known to the practical engineer. *Western Electrician*, Feb. 2, '95.

Small Dynamos. The firm of Daberkow and Rötzsch in Leipzig, Saxony, manufactures small dynamos and gas engines. The gas motors are claimed to be very successful in such sizes even as ¼, ½ and ¾ horse-power. Such machines are used in small electroplating establishments. *Elektrotechn. Anzeiger*, Feb. 7, '95.

Reversible Regenerative Armatures and Short Air Space Dynamos. By W. B. Sayers. The paper deals with a special design. It is divided into the following sections: Reversible Regenerative Armatures; Number of Segments in Commutator; Design of Slotted or Tunnel Armatures; Parallel Running Rocking Brush holders for Reversing Motors; Constant Speed Motors; finally, description of an 80 kilowatt dynamo, built by Mavor & Coulson, 420 revolutions per minute. *London Elec. Engineer*, Feb. 15, '95.

Armature Fault Testing. By R. P. Brousson, A. I. E. E. Illustrated description of a method by which it is possible to locate the position of a faulty coil, that has the advantage that no unsoldering of the connections is necessary. *London Elec. Review*, Feb. 22, '95.

The best Metal for Field Magnet Frames. By A. D. Adams. Read before the Am. Inst. of Elec. Eng's, Jan. 16, 95. Abstract of paper appeared in *The Practical Engineer*, (London,) March 1, 95.

Effect of Armature Current on Magnetic Leakage. By H. D. Frisbee and A. Stratton. Abstract of paper published in *Electrical World* and referred to in our synopsis. *London Elec. Engineer*, March 1, '95.

Large Arc Dynamos. By C. N. Black. Paper read before the National Elec. Light Association. Abstracted in *Elec. World*, March 2, '95. In full in *Elec. Review*, March 6, 95.

The Improved Ball Automatic Dynamo. By Frank H. Widmayer. Illustrated description. *The Elec. Engineer*, March 20, '95.

A Method for Preventing Armature Reaction. Paper read before the Amer. Inst. of Elec. Eng's, by H. J. Ryan and Milton E. Thompson. Copied in part in *Elec. Review*, April 3, '95.

Quantitative Study of the Continuous Current Dynamo. A practical article on the measurements and tests of dynamos, especially as to their commercial and electrical efficiency. *L'Électricité*, April 5, '95.

English Motor-Alternator. In designing the new electric engineering laboratories at University College, London, Dr. Fleming

wished to make provision in the dynamo room for generating alternating currents for experimental purposes by some means which should provide in the most simple manner possible for producing alternating currents of variable frequencies, and also for generating two-phase currents from the same plant. With this object he designed and Mr. Kapp worked out full details and calculations of the machines illustrated and described in *London Electrician*, and *Western Electrician*, April 13, '95.

Armature Reaction in a Simple Alternator Compared with that in a Multiphase Generator. By Ossian Chrytaeus. Writer shows graphically these actions on the fields of different machines. He says: "The effect of the armature reaction in a two-phase generator is to produce a steady demagnetization on the field, which only varies with the angle of lag. If, instead of a two-phase, we were finding the reaction in a three-phase or any multi-phase generator, it is apparent that we could get a similar result. *Elec. World*, April 13, '95.

Factory Practice in the Design and Construction of Dynamos. By C. E. Woods. The first of a series of articles deals with the question: What is a conductor, and what are lines of force? *Elec. Industries*, May, '95.

The Wood Multipolar Dynamo. Description of machine throughout by the Fort Wayne Electric Corporation. *Elec. Review*, May 1, '95.

Calculation and Construction of Direct Current Machines. By R. V. Picon. A popular treatment. *L'Eclairage Electrique*, May 4, '95.

A Radical Departure in Dynamo Design, and the First Plant Installed. The type of dynamo designed by Messrs. Ryan and Thompson has been built and the first direct coupled machine of 100 K. W. has been installed. *Elec. Industries*, June, '95.

Some Practical Hints in Dynamo Design. By Gilbert Wilkes. From the *Bulletin of the University of Wisconsin.* Author considers general features, and then in particular commutator construction, prevention of sparking, relation of size of armature to output, and relation of field loss to radiating surface. *Western Electrician*, June 1, '95.

Location of Grounds in Armatures, Fields, etc. By Clarence E. Gifford. Paper read before the Am. Inst. of Elec. Engineers, June 25, '95. The methods herein described are but simple adaptations of the principle of the Wheatstone bridge. *Elec. Engineer*, July 3, '95; *Elec. Review*, July 17, '95; *Western Eletrician*, August 3, '95.

Compounding Dynamos by Armature Reaction. By Prof. Elihu Thomson. Paper read before the annual meeting of the Am. Inst. of Elec. Engineers, June, '95.

Author described a type of dynamo not claimed to have any commercial importance, except perhaps in very special cases, but interesting in several respects. The machine may briefly be described as a four-pole dynamo with windings on only two opposite poles. Under no load the magnetic flux tends to pass entirely through the

armature between the "live" poles while with load the distortion of the field causes some of the flux to be diverted through the "dead" poles. By properly choosing the position and spread of the "dead" poles in relation to the wound or excited poles, and adjusting the magnetomotive force of the initial field relatively to the turns on the armature and the speed of driving, the effect of compounding or over-compounding may easily be obtained. The paper contains curves giving the results of experiments under different loads, showing that a large range in compounding is possible. A feature of the machine which developed itself when carbon brushes were used, was that even at heavy loads the brushes could be set back from their maximum position, or true diameter of commutation, and that the movement was attended with little, if any, increase of spark, while the potential steadily went down. *Elec. World*, July 6, '95; *Elec. Review*, July 10, '95; *Elec. Engineer*, July 10, '95; *Electricity*, July 17, '95.

Armature Cross Turns in Continuous Current Dynamos and their Effects. By George Adams. A mathematical deduction. *London Elec. Review*, July 19, '95.

Multiple Current Dynamo. By Rankin Kennedy. This machine was first patented by the author in 1882. If we take a four-pole dynamo, and instead of making the poles alternating N.S. N.S., make two upper ones N. N., and the lower ones S. S., it immediately becomes a multiple current dynamo, and we can take a current at 460 volts from one pair of brushes, and another at 230 volts from the second pair, or 120 and 240 volts may be so obtained. *Electricity*, July 24, '95.

Commutator with Movable Segments. This commutator differs from the type at present in use in that where renewal is essential it is not necessary to disengage the armature wires from their segments. The central bushing is fixed and maintained in position in the same manner with existing types, the only difference being that the contact surface is plane from one end to the other. Each segment is, on two sides, shaped into a double bevel, which engages in two V grooves. In order to renew the commutator, it is not necessary to withdraw the tube or bushing from the shaft, nor to detach the wires. Illustrated description in *London Elec. Engineer*, Aug. 2, '95.

Dynamos. First aid to the injured. By Arthur M. Logies, M.E. Discussion of an open circuit in armature coil. *Power*, September, '95. Continued in subsequent issues.

Sparking at the Commutator. By A. W. Foster. Author gives the following as some of the causes for sparking: (*a*) friction in bearings and brushes; (*b*) insufficient pressure of the brushes against the commutator; (*c*) too great pressure of the brushes against commutator; (*d*) the polished surface of carbon brushes against the commutator; (*e*) powerful currents set up in the short-circuited coils undergoing commutation. A number of practical methods are explained for lessening the trouble. *Elec. Industries*, October, '95.

Heating of Dynamos. By Ernest Wilson. When an armature is rotating in a magnetic field and delivering its current to the exter-

nal circuit, or receiving a current from the external circuit, there are in it four causes for dissipation of energy:

(1) The armature current itself, in virtue of the electrical resistance of the armature conductors; (2) Magnetic hysteresis; (3) Induced currents in the iron of the armature; (4) Induced currents in the armature conductors. These four points are minutely discussed and the results of experiments summarized in tables, the most important of which are the following:

TABLE I.

Maximum average induction per square centimetre in armature. B	Ergs per cycle per cubic centimetre due to hysteresis. $\frac{1}{4\pi}\int H d B$.*	500 revs. per minute. †	‡	1,000 revs. per minute. †	‡	1,290 revs. per minute. †	‡
6,000	5,200	1,400	52	2,300	118	2,700	160
7,000	7,900	1 800	76	3,200	174	3,600	233
8,000	9,500	2,200	92	4,000	212	4,700	288
9,000	11,400	3,200	115	5,400	264	6,400	361
10,000	13,400	4,300	140	7,400	327	8,600	447

* These values have been purposely chosen high and probably represent magnetically a much worse sample of soft iron than we have in our armature core.
† Ergs per cycle per c.c.m. due to induced currents for 1 mm plates.
‡ Watts for whole core due to hysteresis and induced currents combined.

TABLE II.

Rise in degree Fahr. above atmosphere. (Atmospheric temperature, 20° C.)

Hours after starting test.	Stationary armature.				Rotating armature.				Magnet winding	
	Test I.		Test II.		Test III.		Test IV.		Test V.	
	R*	T†	R	T	R	T	R	T	R	T
1	29.4	23	....	....	54.6	38	....	....	....	....
2	36.3	31	18.5	11	67.5	45	53.4	29	44	....
3	48.6	38	....	15	73.7	48	....	....	57	40
4	55.4	46	25.0	18	79.8	50	65.0	41	65	46
5	62.9	47	26.0	19	84.6	51	68.4	45	69	54
6	65.7	50	27.4	22	86.0	52	74.6	49	72	57

* By resistance.
† By thermometer.

—*London Electrician*, Oct. 11, '95.

Cup Armature Dynamo. By Dr. G. H. Lahn. The principal parts of this new machine have the form of a cup, for which reason the name of cup armature dynamo has been chosen. The core of the cup armature is laminated different from the ordinary type of machine, the planes of lamination being rectangular to the motion. *Western Electrician*, Oct. 19, '95.

Behavior of the Carbon Brush on the Commutators of Direct Current Power Generators. By Harris J. Ryan. From the Sibley *Journal of Science.* An investigation of the manner in which the carbon brush takes the current off the commutator, so that it is unnecessary to have the brushes moved from point to point with every

variation of load, in order to avoid sparking. *Electricity*, October 30, '95.

Principles of Dynamos. By W. H. Freedman, E. E. Lecture delivered before the Henry Electrical Club. The article treats the fundamental principles involved and forms the first of a series of lectures on similar subjects. ELECTRIC POWER, Nov., '95.

Design and Construction of a Motor Starting Box. A detailed description with line drawings illustrating the design. *Elec. Industries*, Nov., '95.

Self Lubricating Dynamo Brush. Lubricating material in the form of a paste, which melts at about 60° centigrade, is contained in holes drilled into the brush. Thus, as the brush becomes warm, the material gradually melts, thus automatically lubricating the commutator. *Elektrotechn. Anzeiger*, Nov. 3, '95.

Armature Winding and Connecting Considered as a Mathematical Problem. By Harrison H. Wood. This paper is not so difficult or complicated as the title makes it appear. It simply gives the various formulæ necessary to determine the way in which windings must be connected to the commutator bars. *Elec. World*, Nov. 23 and 30, '95.

The Shunt Dynamo. By Max Osterberg, E. E. Lecture delivered before the Henry Electrical Club. Speaker pointed out the various methods of field excitation, devoting his attention principally to the shunt machine and dwelling on the regulation of the same. ELECTRIC POWER, Dec., '95.

The Series Dynamo. By Joseph T. Monell, E. E. Lecture delivered before the Henry Electrical Club. Author dwelled principally on the regulation of the more important series machines. ELECTRIC POWER, Dec., '95.

Coupling Compound Machines in Parallel. A short paper. A few practical hints as to possible troubles. *Western Electrician*, Dec. 21, '95.

EDUCATIONAL.

Some Aspects of Electrical Education. By W. M. Stine. A series of articles, headed "The Education of the Electrical Engineer." *Elec. Engineer*, Dec. 5, concl. Dec. 12, '94.

The Training of the Electrical Engineer. By James B. Cahoon. Among the most interesting points in this paper is the gradual development and final management of the expert course in the Thomson Houston works. ELECTRIC POWER, Jan., '95.

Lord Kelvin's Popular Lectures and Addresses, reviewed in detail by T. C. Mendenhall. *Science*, Jan. 11, '95.

The Training of the Electrical Engineer. By James B. Cahoon. Concluded from the January issue. The writer mentions some difficulties encountered after, as well as before, the tyro has developed into an electrical engineer. ELECTRIC POWER, Feb., '95.

Electrical Education. By Edgar Kidwell. Referring to the paper by Prof. Stine on "Some Aspects of Electrical Education," the writer says: 1. There is in it too much matter irrelevant to the subject; 2. The educational views are not sound, and some of the statements are not founded on facts; 3. The views regarding an engineer's duties and qualifications are not in conformity with the demands of actual practice. *Elec. Engineer*, Feb. 13, '95.

The Scientific Foundations of Electrical Engineering. By F. G. Baily, M. A. Paper read before the Northern Society of Electrical Engineers. The paper is principally based on the accuracy desirable and the accuracy obtainable in applied science. *London Elec Engineer*, March 15, '95.

The Glasgow and West of Scotland Technical College. By Andrew Pinkerton. A review of its history and gradual development. *Elec. World*, March 16, '95.

New Institute for Physics and Electrical Engineering at Darmstadt, Germany. A description of the buildings and the general arrangements of the laboratories. *Elektrotechn. Anzeiger*, March 21, '95.

Electrical Engineering at Purdue University. A description of the library, with numerous illustrations. *Elec. World*, March 23, '95.

Educational and Industrial Value of Science. By Dr. H. S. Carhart. Lecture delivered at the dedication of the new Hale Scientific Building of the University of Colorado, March 9, '95. Abstract of same appeared in *Western Electrician*, March 23, '95.

The Scientific Foundations of Electrical Engineering. By F. G. Baily, M. A. Paper read before the Northern Society of Electrical Engineers, March, '95. The paper is reprinted in full in *Electricity*, April 3, '95; *Elec. Review*, May 1, '95.

City and Guilds of London Institute. The following were the questions asked in electric lighting and power transmission at the preliminary examination 1894:

1. Define the terms "in parallel," "in series," "on open circuit," and give sketches in illustration.

2. Describe the Leclanche cell, and add some hints as to how to maintain it in working order.

3. Sketch the connections needful for bells between two places, A and B, so that a person at B can ring the bell at A, and that a person at A can ring the bell at B. One (of two or three cells) only to be used, and only one bell to ring at a time.

4. A lamp circuit is supplied at a pressure of 100 volts. There are 42 lamps, all in parallel, and the resistance of each lamp is (when hot) 150 ohms. How much current will the circuit take when all the lamps are on?

5. How can you convert a bar of iron into a magnet? If you have a small E. M. F., and no appreciable resistance in the rest of the circuit, would you use thin wires, or thick, for winding an electromagnet?

6. If electric bells are to be made to ring (by a magneto-ringer) through a line many miles in length, why must fine wires be used both in the coils of the ringer and in the coils of the electromagnet in the bell?

7. Why is there a permanent steel magnet in the bells that are to be used with magneto-ringers?

8. Describe shortly the construction of a glow lamp. Why does the filament become hotter than the platinum leading-in wires? Why does the globe of a bad lamp get very hot?

9. How many horse-power is required to drive a current of 100 amperes through a resistance of 7½ ohms?

10. State the principles on which the Cardew voltmeter is based.

11. Name the principal parts of an arc lamp, and say what is the use of each part.

12. Define "work" and "power." How many foot-pounds of work will be done in 20 minutes by a motor working at 4 horse power?

The answers to these questions are given in *London Elec. Engineer* April 19, '95.

Opportunities in Electrical Engineering. By A. A. Atkinson. "I can probably best indicate the situation to the electrical student by outlining the kinds of positions that may be open to him: 1. Original investigation and invention; 2. Consulting and constructing engineer; 3. Superintendent of light and power plant, including isolated and central station work, stationary power, railways, mining, etc.; 4. Artisans in light and power; 5. Artisans in factories. *Electricity*, May 1, '95.

An Interesting Franklin Document. By W. M. Stine. A photographic reproduction of an autograph letter written by Benjamin Franklin to an eminent English scientist. The letter was preserved as an heirloom in the family until 1892, when it came into possession of the electrical department of Armour Institute. *Elec. Engineer*, June 12, '95.

Electrical Engineering Course at the University of Wisconsin. By R. Macrae. A short description of the work required in the various departments. ELECTRIC POWER, July, '95.

Electrical Engineering Education. By Prof. Wm. A. Anthony. Author gives his views on methods of teaching mathematics for the electrical engineering profession, and then adds an illustrated description on Cornell University laboratory training. ELECTRIC POWER, August, '95.

How Shall We Educate Our Sons for the Electrical Profession? By Nelson W. Perry, E.M. An article contributed to ELECTRIC POWER, September, '95.

Mechanical Principles of Electrical Engineering. By H. B. Ransom, A.M.,I.C.E. An address delivered to the students at the Croydon County Polytechnic, England. *The Practical Engineer*, Sept. 20, '95.

The Aim of Laboratory Training. By W. M. Stine, Ph.D. Writer states his views in ELECTRIC POWER, October, '95.

Electrical Engineering Department of the University of Illinois. Description of laboratories. *Elec. World*, Nov. 2, '95.

Roundabout Notes in Electrical Europe. By E. J. Wessels. A series of articles in which the writer mentions his engineering experience abroad. *Elec. Engineer*, Nov. 6; also previous issues.

Progress of Electrical Engineering in Germany. By Dr. von Stephan. Covering the period from October, '94, to September, '95. *Elektrizität*, Nov. 9, '95.

City and Guilds Examinations, 1895. The answer to a set of questions given at the examination. *London Elec. Engineer*, Nov. 15, '95.

Some Observations upon Electrical Engineering Progress in Europe. By Chas. T. Rittenhouse, M. E., E. E. (Illustrated.) ELECTRIC POWER, Dec., '95.

ELECTRO-CHEMISTRY.

Electroplating Plants. By H. G. Brownell. A review of the poor condition in which most electroplating establishments are to be found, and the cause explained by the fact that but few electrical engineers devote themselves to that branch. *Elec. Industries*, Dec., '94.

Analysis of Electrolyzed Water Pipes. A report prepared by Mr. Joseph Rigge, at the instance of Major J. B. Furay, of Omaha, Nebraska. *Am. Gas Light Journal*, Dec. 3, '94.

Soldering Aluminium. A special process is described in the *London Practical Engineer*, Dec. 7; *London Ind. and Iron*, Dec. 7, '94.

Practical Applications of Ozone. By Dr. O. Frölich. Read October 6th before the German Electro-Chemical Society. An explanation of the apparatus and a number of applications such as chemical, ventilation, spirits, tobacco, oil, bleaching, starch, etc. *London Elec. Review*, Dec. 7, '94.

The Electro-chemical Applications of Electrica. Energy. Special reference to the manufacture of ozone, with a number of illustrations well executed. *L'Industrie Electrique*, Dec. 10, '94.

The Electro-Metallurgy of Gold and Silver. By A. L. Eltonhead. Read before the Engineer's Club, Philadelphia. Besides a description of a new process where cyanide of potassium is used as reacting agent, the writer gives a historical review of similar processes. *Elec. Review*, Dec. 12, '94.

How an Electric Current Introduced Gas into an Electric Culvert. By Mr. I. W. Durkin, of Southampton, England. This seems to be simply caused by electrolytic action. *Am. Gas Light Journal*, Dec. 24, '94.

Reduction of Aluminium by Carbon. Experiments made by Henry Moissan show that in an electric furnace the liquid aluminium is not reduced by carbon, but that the reduction takes place while the vapors of those two bodies are at a very high temperature. In this case the aluminium loses its oxygen and gives metallic aluminium. Description of experiments in detail in *Rev. Industrielle*, Dec. 22, *Bull. Internat. de l' Électricité*, Dec. 31, '94.

Theory of Electrometallurgy. By Prof. Francis B. Crocker. After dividing the subject into three parts: Electrolytic Metallurgy, Electric Smelting and Electrical Working of Metals, the writer gives some short historical notes. He then deduces the laws of electrometallurgy, and all in all this paper forms an entirely original compilation of the facts known, and furthermore contains a number of original views and suggestions opening in that way a wide field for new researches. ELECTRIC POWER, Jan., concl. Feb., '95.

Theory of Electrometallurgy. By Prof. Francis B. Crocker, Ph. D. Copy of the paper printed in the January and February issue of ELECTRIC POWER, and abstracted in Synopsis of February and March, appeared in *School of Mines Quarterly*, Jan., '95.

Electrolyzed Water Pipes. By J. S. Furay. Abstract of Report on the Analysis of the Water Pipes in Omaha, read at the Montreal meeting of Fire Chiefs. Under the action of electrolysis our city service pipes have much of the iron, their backbone of strength, corroded away, leaving behind in its place a frail shell of graphite iron, incapable of sustaining even the usual pressure of the mains. *Elec. Age*, Jan. 5, '95.

Electro-Chemical Progress During the Year 1894. By J. Swinburne. The writer points out the work that has been done on copper refining, chlorate of potash, caustic soda, ozone, nitro-compounds, nitro-benzol, etc. *London Elec. Review*, Jan. 11, '95.

Gas by Electricity. By F. L. Slocum. A great deal has been said and written on Calcium Carbide lately. The writer has prepared a paper in which he gives tables for the various costs and comes to the following conclusions: It does not seem that acetylene will be used for carborating purposes in the ordinary gas works of the country. It can, however, be most profitably used for small isolated plants, such as seaside hotels or country homes and for railroad car lighting. *Am. Manufacturer*, Jan. 11, '95.

Electrolysis and Trolley Speed in Brooklyn. Abstract of Mayor Schieren's message, in which he pointed out that the trolley companies are ready to begin and continue the remedial process against electrolytic action. *St. R'y Gazette*, Jan. 12, '95.

Electrolysis in San Francisco. An investigation of the trouble caused and damage done by poor bonding of rails, and making direct connections with gas mains. *Am. Gas Light Journal*, Jan. 14, '95.

The Utilization of Ozone. By Dr. O. Frölich. The paper referred to in Synopsis of January has been reprinted in abstract in *London Electrician* and *Electricity*, Jan. 16, '95.

Investigation of the Electrolysis of Pipes by Escaping Electric Railway Currents in Brooklyn. By Prof. John A. Barrett. A report made to the Brooklyn Subway Commissioners. It is stated summarily that under the present condition in Brooklyn it appears indisputable that earth currents from trolley roads are causing extensive electrolysis of water and other pipes and conductors imbedded in the ground at an indeterminate but serious rate. It also appears that there are practical means at command which are being neglected and which, if properly organized and applied, would largely abate, if not altogether arrest, the ongoing destruction. *St. R'y Gazette*, Jan. 26, '95.

Theory of Electro-Metallurgy. By Prof. Francis B. Crocker. Concluded from the January issue. In this part the author treats of Temperature Coefficient of Electrolytes, Weight of Deposit, Electrolytic Polarization, Selective Electrolysis, Chemical Purity and

Physical Nature of Deposit, and concludes this able paper with the Principles of Electrical Heating. ELECTRIC POWER, Feb., '95.

Electrical Desinfection by the Hermite System. By M. D. Farman. A complete description of the methods, machinery, etc. *Bulletin de la Société Internationale des Electriciens*, Feb., '95.

Calculation of the Price of Primary Battery per Horse-Power-Hour. By Dr. W. Ford. The writer concludes that the price per horse-power-hour of a Daniell cell is not quite one Mark (24 cents); that of a Bunsen cell 75 Pfennig (18 cents). *Elektrochem. Zeitschr.*, Feb., '95.

Ions. By Dr. Heinrich Gerstmann. The first of a series of articles, in which the writer points out some elementary facts as to composition and decomposition, explaining the chemical energy of atoms, and proposing to investigate now the electric energy. *Elektrochem. Zeitschrift*, Feb., '95.

Rail Bonding and its Bearing on Electrolytic Corrosion. By Geo. P. Low. A communication in discussion of a paper by Mr. Farnham, on the destructive effect of electrical currents on subterranean pipes, read in April, '94. The essence of this communication is that, in the opinion of the writer, the problem of eliminating electrolytic corrosion is simply one of judicious bonding. *Trans. Am. Inst. Elec. Eng'rs*, Feb., '95.

A New Theory of Electrolysis. By A. H. Bucherer. Mr. Bucherer's explanation of the phenomena of electrolysis differs from the widely accepted one of Nernst, in that the former involves consideration of the partial pressures of the metallic vapor and the non-metallic constituents of a solution, while the latter considers osmotic pressures alone. One of the points made by Mr. Bucherer against the theory of electrolysis, based upon the neutralization of static charges carried by ions, is that it involves a denial of the principle implied in the laws of thermodynamics, by asserting that the neutralization occurs with an absorption of energy, work being done to deprive an ion of its charge. *Elec. World*, Feb. 2, '95.

Electrolysis by Electric Railway Return Currents. By A. J. Rowland. The writer points out that "the electrolytic action in the soil, whereby the salts therein contained are dissociated to produce chemical decomposition of pipes or rails must follow the laws of electrolysis and the amount of decomposition be proportional to the current flowing. The important thing, therefore, is to know how much current flows through the soil from rails to pipes, or vice versa. A measurement of difference of potential between these electrodes gives no idea of this current, unless resistance be assumed either negligible in all cases, or alike; for by Ohm's law, $E = C R$ and C, may be large or small, according as R is large or small." *Elec. World*, Feb. 2, '95.

The Real Situation of the Electro-Chemical Industry. By M. R. Lucien. *Sciences et Commerce*, Feb. 5, '95.

Dry Batteries. By L. K. Böhm. After a few introductory remarks as to open circuit batteries, the writer explains some historical

dry batteries, and then describes the Hellesen, Bryan and Koller batteries. He closes with the description of the various uses that a dry cell may be put to. *Elec. World*, Feb. 9, '95.

Hermite System for Desinfecting Private Houses, with illustrations of the various apparatus used. By J. A. Montpellier. *L'Electricien*, Feb. 9, '95.

The Actual Situation of the Electro-Chemical Industries. By R. Lugion. A communication presented before the Belgian Society of Electricians. To be continued in subsequent issues. *L'Electricien*, Feb. 9, '95.

Carborundum. An article on the manufacture of this new abrasive material. It says that the Carborundum Company has made a contract with the Niagara Falls Power Company for 10,000 H. P. *Am. Man. and Iron World*, Feb. 15, '95.

Primary Battery Testing. By T. M. Berthold. Methods and apparatus of the German Telegraph Department for finding commercial efficiency. Special reference is made to dry batteries. *Elec. Review*, Feb. 20, '95.

Electrolysis of Fused Salts. By Mr. E. Andreoli. In this paper, to be continued in subsequent issues, the author shows that the electrolysis of fused salts preceded that of salts in solution, reviewing the different experiments in this direction of Davy, Faraday and Matthiesen. *L'Electricien*, March 9, '95.

The Electrolysis of Gold. By W. N. Keith. A very thorough paper on this subject, which is attracting wide attention in scientific and financial circles lately. *London Elec. Engineer*, March 15, '95.

A Method of Permanently Protecting Underground Pipes from Electrolytic Corrosion. By Harold P. Brown. A successful method of pipe protection must solve the following problems: 1. To keep the pipes at least one volt negative to the rails at all points and at all times; 2. To diminish as much as possible the flow of current on the pipes; 3. To secure some permanent nonoxidizable contact of low resistance, between the pipes and the necessary feeder wires. *Street R'y Review*, March 15, '95.

On Ions. By Dr. Heinrich Gerstman. The last of the series of articles previously referred to. *Elektrochem. Zeitschrift*, April, '95.

On the Work Done in Electrolysis. By Theodor Gross. The author assumes a stationary voltaic current, isolated from all external influences and determines then: 1, the chemical energy variations and changes; 2, the heat developed; 3, the Peltier effect. *Elektrochem. Zeitschrift*, April, 95.

Test of the Gulcher Thermoelectric Battery. Translated from the *Elektrotech. Zeitschrift* and *L'Eclairage Electrique*. These tests are especially interesting on account of the scarcity of accurate data with regard to the commercial efficiency of the best thermo-electric batteries. *Elec. Review*, April 3, '95.

Determination of the Electric Conductivity of Certain Salt Solutions. By Albert C. MacGregory. During the last few years a great deal of work has been done in the line of determining the electric conductivity of certain salts in their water solution. Two objects are accomplished by means of such observations, namely the determination of the velocities of the so-called ions, and in gaining of some insight into the condition of the salts when in solution. The salts investigated were: Calcium sulphate, calcium chloride, calcium nitrate, calcium acetate, strontium chloride, strontium nitrate, strontium acetate, barium acetate, silver acetate, potassium oxalate. *Physical Review*, March-April, '95.

Legal Aspect of Electrolysis. By Henry C. Townsend. *Cassier's Magazine*, April, '95; *Street R'y Gazette*, April 6, '95.

Gas Batteries. By C. J. Reed. The writer describes the following experiments: 1. Oxygen and hydrogen with electrodes of platinum foil; 2. Electrolytic oxygen and hydrogen with electrodes of platinum foil; 3. Hydrogen from zinc, atmospheric air and electrodes of platinum foil; 4. Electrolytic oxygen and hydrogen with electrodes of platinum foil and platinum black. *Elec. World*, April 6, '95, and April 20, '95.

On a Method of Electrolytic Bleaching. Abstract of a paper read by Louis J. Matos before the Franklin Institute. *Electrotech. Anzeiger*, April 14, '95.

Electricity Direct from Coal. By Alfred H. Bucherer. In the extensive discussion of Dr. Borcher's work, one point has been altogether ignored, and this point is of such essential importance in the problem of the conversion of the potential energy of coal into electric energy that it deserves to be fully elucidated. This point is the relation of the chemical to electrical energy. Reprint from Franklin Institute *Transactions* in *Am. Gas Light Journal*, April 15, '95.

Specific Resistance and Temperature Coefficient of Copper-Zinc Alloy. By Dr. Robert Haas. The following table shows results of experiments:

	Percentage of Zinc by Weight.	Specific Resistance in Ohms.	Temperature Coefficient.	Specific Conductivity.
1	0.	.01576	.004316	63.45
2	0.	.01592	.004323	62.81
3	0.71	.01833	.003725	54.56
4	1.56	.02133	.003185	46.88
5	3.07	.02372	.002913	42.16
6	5.51	.03010	.002383	33.22
7	9.08	.03638	.002044	27.49
8	18.02	.04763	.001691	21.00
9	20.29	.05064	.001639	19.75
10	22.71	.05424	.001607	18.44
11	28.16	.05826	.001581	17.16
12	34.23	.06302	.001579	15.87
13	40.28	.05789	.002116	17.27
14	42.55	.05307	.002376	18.84
15	45.19	.04712	.002851	21.22
16	46.85	.04314	.003105	23.18
27	99.53	.05883	.003847	17.00
28	100.	.05683	.004029	17.60

Elektrotechn. Zeitschrift, May 2, '95.

Metallurgical Applications of the Electric Furnace. By Moissan. A complete historical sketch of the development of the subject. *L'Eclairage Electrique*, April 27, '95.

Cyanide of Potassium and Electricity. By Emile Andreoli. Writer gives a few comments on the decision in the Court of Appeals in connection with the lawsuit of the Cassel-Gold Extracting Company against the Cyanide of Gold Recovery Syndicate, in *London Elec. Review*, May 17, '95.

Notes on Pipe Electrolysis. By Maurice Hoopes. The writer has found a graphical investigation of the subject to present the various phases in a clearer way, and gives his analysis in *Elec. World*, May 25, '95.

Electricity in the Bleaching of Textile Fabrics. By Louis J. Matos, in *Textile Industries*. A description of the Hermite bleaching process. *Scientific American*, June 8, '95.

Maximum Possible Efficiency of Galvanic Batteries. By Henry Morton, Ph. D.

In all the batteries here referred to, there are the following common features :—1st. The energy is derived from the combination of zinc with dilute sulphuric acid. 2d. The supply of oxygen required for this combination is obtained by the decomposition of water or some other compound in aqueous solution. In other words, the batteries here considered are the Smee, the Daniell, the Grove and the various forms in which chromic acid is the oxygen-supplying substance.

The various experiments show that in the best forms of battery an allowance of one horse-power for each pound of zinc consumed per hour would be a liberal one, if something is allowed, as it must be, for the resistance, local action, etc. It may, however, be asked,—If such an improvement has been made as above shown from the Smee battery giving ⅓ to the Poggendorff yielding 1¼ horse-power, may we not expect further improvements as great in amount? To this I answer, certainly not in this class of batteries. The entire energy of the reaction between the zinc and dilute acid is 3,006 British thermal units. This would represent 2,320,632 foot-pounds, or 70.62 horse-power for one minute, or 1.17, say 1⅛, horse-power for one hour, and this would be an absolute maximum which could never be reached, far less exceeded.

Of course, if we could use some other and more efficient reaction than between zinc and sulphuric acid, some gain might be secured, but nothing of that sort has ever been accomplished, nor from what is known of the combining or thermal equivalents of the available elements, is much to be expected in that line. At all events, we may well accept this as a certain fact, that in any known form of galvanic battery the round figure of a pound of zinc per horse-power per hour is an outside figure for efficiency, and when any one asserts that more than this has been secured, there is certainly some mistake or fraud. *Cassier's Magazine*, June, '95; *Am. Gas Light Journal*, June 24, '95.

Some Notes on the History of Electric Smelting. This is practically a review of the development of the electric furnace. *Progressive Age*, July 1, '95.

Action of Boynton Multivolt Battery. By Wm. A. Anthony. Writer explains some details of the battery as to leakage, resistance and E. M. F. *Elec. Engineer*, July 10, '95.

Spectroscopic Study of the Carbons of the Electric Furnace. By H. Deslandres. Writer has been led to the study of the electric furnace, to ascertain on the one hand their value in analysis, and on the other to determine the complete spectrum of carbon. Some of the results obtained are given in *Am. Gas Light Journal*, July 22, '95.

Limits of Electrolysis. M. Marcellin Berthelot, in *Ann. Chem. Phys.*, states that he has formerly shown by experiment that in the electrolysis of an alkali salt, of which neither the acid nor base is oxidized or reduced during the operation, the minimum E. M. F. necessary for electrolysis is the sum of two equivalent quantities—the one being the heat absorbed in the separation of the acid and the base in dilute solution, the other the heat of decomposition into oxygen and hydrogen of the water holding the substance in solution. In the case, for instance, of potassium sulphate in dilute solution the sum of the two quantities of heat is $15.7 + 34.5 = 50.2$ cal, when one gramme of hydrogen is liberated. This is equivalent to 2.20 volts, a number which Le Blanc has obtained by direct observation. Other results are quoted in support of the above law, which the author maintains as an empirical law, independent of any hypothesis regarding the condition of the dissolved salts in solution. *London Elec. Engineer*, July 26, '95.

Electro-Deposition of Brass. By Frank Sutton, E. E. The subject chosen was the electro-deposition of alloys, showing: 1st. Under what conditions they would alloy: that is, total necessary voltage, etc. 2d. The actual voltage that does the work. 3d. The best solutions to use. 4th. The nature of the deposit.

In summing up the results obtained in the case of a copper and zinc solution, the following statements may be made: 1. The alloy deposited depends upon the impressed electromotive force. 2. As the impressed E. M. F. is increased the alloy will change its proportions, these proportions depending on the velocities of migration of ions in the different salts. 3. The amount of zinc increases directly with the impressed E. M. F. and finally reaches a point where more of it is deposited than of the copper. 4. The best alloys are obtained when the impressed E. M. F. exceeds the counter E. M. F. by a small amount. 5. As the impressed E. M. F. is increased, the C. E. M. F. will increase, but at a much reduced rate, and this rate decreases so much that when the impressed is very high, the counter is negligible.

Now this C. E. M. F., although it does cause a certain amount of energy to be lost, may be considered a help as far as electro-plating work is concerned as it really throttles the current and keeps the ions from combining too rapidly.

This course of experiments was carried on in the electrical en-

gineering department of Columbia College. ELECTRIC POWER, August, '95.

New Features in the Electrolytic Alkali Industries. By Dr. H. Weyer. *Electro-chemische Zeitschrift*, August, '95.

On the Installation of Electro-Chemical Laboratories. By Dr. M. Krueger. *Electro-chemische Zeitschrift*, August, '95.

Indirect Electrolysis. M. Andreoli has described in *Le Génie Civil* an experiment on indirect electrolysis. Taking a cell divided into three compartments by porous diaphragms, a solution of any salt is placed in the central compartment, whilst the two electrodes are placed in the side compartments immersed in similar or different electrolytes. The decomposition of these latter is, on the current being passed, effected as if the central compartment did not exist, the solution in it being unaffected. In this form the experiment is an old one, but M. Andreoli finds that if a plate or series of plates is placed in the solution in the central compartment, reactions occur which can only be attributed to an indirect or secondary electrolysis, if, for example, the two outer compartments are filled with a solution of common salt, and the central one with a solution of cyanide of gold. Let the anode in the one compartment be of carbon, and the cathode in the other of iron. On passing a current under these conditions chlorine is evolved at the carbon electrode, and caustic soda produced at the other, the cyanide solution being, as aforesaid, unaffected. If, however, whilst the current is passing, a series of metal plates are immersed in the cyanide solution, the gold is deposited on them, though neither chlorine nor soda appears to pass into the central compartment. *London Elec. Engineer*, August 9, '95.

Electric Furnace and Chemistry at High Temperatures. By H. Moissan. From *La Nature*. A description of the work that has been done in connection with extremely high temperatures since 1892. *Elec. Engineer*, Aug. 28, '95.

Thermo-Chemical Carbon Battery. M. Korda, in *Compt. Rend.*, states that experiments made with a view to ascertain whether in the reduction of metallic oxides there is a development of electrical energy, show that only in two of the cases investigated is there any distinct E. M. F. Barium peroxide in contact with carbon heated at dull redness gives an E. M. F. of about one volt. Other peroxides, such as those of manganese and lead, show no similar behavior, probably because the product of reduction is a conductor and forms short-circuits with the carbon. Copper peroxide and carbon, when separated by fused potassium carbonate, gives an E. M. F. of 0.9 to 1.1 volt. If the potassium carbonate contains water, the current is at first in the opposite direction, but changes as the temperature rises. In both cases the E. M. F. is considerably lower than that calculated from the known thermal disturbances, and it follows that only part of the energy is liberated as electrical energy. Faraday's law is not applicable, because of the continuous supply of extraneous energy in the form of heat. *London Elec. Engineer*, Aug. 30, '95.

Method for Producing Thermo-Electric Currents. By Gustav Meyer. Author heats and cools the soldered connections alternately, thus being able to produce an alternating, a direct or multiphase current. *Elektro-chemische Zeitschrift*, September, '95.

Action of the Electric Current in Aluminium Wire. From *La Nature.* Description of several experiments with their accompanying phenomena. *Elec. Engineer*, Sept. 4, '95.

New Process of Depolarizing Batteries. From *La Nature.* Method explained and illustrated in *Scientific American Supplement*, Sept. 14, '95.

An Electrolytic Process for the Manufacture of White Lead. By R. P. Williams. Read before the Am. Chemical Soc. This process is a radical departure from the old method in not employing acetic acid at all, but in acting upon lead with nitric acid which is generated by electricity. For detailed account of actions and reactions see *Elec. World*, Sept. 14, '95.

Generation of Electricity by Chemical or Thermo-Chemical Methods. By Dr. O. Schmidt. Lecture delivered before the Verband Deutscher Elektrotechn. in Munich, July 6, '95. The speaker discussed the various methods which have been employed to utilize coal for the direct transformation into electrical from its potential energy. *Die Elektrizität*, Sept. 14, '95.

Theory of the Galvanic Element in Connection with the Theory of Electric Waves. By G. Schmitz-Dumont. In the following an attempt is made to furnish a theory of mechanical motions of elements on the basis of modern theories of vibration. *Electrochemische Zeitschrift*, October, '95.

Hermite Process of Deodorizing Sewage. By J. Napier, F.C.S. Paper read before the British Assoc. and reprinted in *London Elec. Review*, Oct. 4, '95.

Experience in the Manufacture of Incandescent Electric Lamps With Carbide Filaments. Communicated by the incandescent lamp factory at Oberbruch, Rhineland. *Elektrotech. Anzeiger*, Oct. 10, '95.

Galvanic Zincing of Iron. Discussion of the qualities of the zinc covering and its protecting action, and the conditions which influence the success of the galvanizing process, as the surface of the article, the distribution of the current and its quantity, as well as the composition of the wash. *American Man. and Iron World*, Oct. 18, '95.

Woolf Electric Disinfecting Plant in Philadelphia. Under the auspices of the City Health Department, Philadelphia, has inaugurated a Woolf Disinfecting Plant. *Elec. Engineer*, Oct. 23, '95.

Niagara Falls Power at Work. The Carborundum Company has successfully started the manufacture of carborundum at Niagara Falls on Oct. 19, '95. Reported in *Elec. Review*, Oct. 23, '95 ; *Elec. Engineer*, Oct. 23, '95 ; *Elec. World*, Oct. 26, '95.

On the Direct Application of Calcium Carbide for Electric Lighting, and the Glow Lamp with Calcium Carbide Filaments. By Otto Mielke and Eduard Worringen. Authors explain that calcium carbide could be used as filament in glow lamps, and judging from some experiments made so far, the work promises favorable results. *Elektrotechn. Anzeiger*, Oct. 20, '95.

Alternate Current Electrolysis. By W. R. Cooper, M. A. This practically forms the abstract of a paper presented to the Royal Soc. in 1893 by Hopkinson, Wilson and Lydall. It was found that one-tenth of a coulomb suffices to fully polarize 150 sq. cm. of platinum, or 000,000,07 gramme of hydrogen is sufficient for one sq. cm. of platinum. *London Electrician*, Oct. 25, '95.

Electro-Metallurgy as Applied to Silver Refining, and Incidentally to other Metals. By Geo. Faunce, B. A. S. A lecture delivered before the Franklin Institute. Author gives a historical sketch and then goes into the principles of electro-metallurgy. *London Elec. Review*, Oct. 25, '95, and subsequent issues.

Local Annealing of Hard Faced Armor Plates. By Hermann Lemp, Jr. Paper read before the Amer. Inst. of Elec. Engineers, Oct. 23, '95. Description of a successful method, and at the same time a review of what has been done in the way of experiments concerning the subject. *Electricity*, Oct. 30, '95; *Elec. Engineer*, Oct. 30, '95.

Magnetization and Concentration of Iron Ores. By Prof. Phillips. Read at the Amer. Inst. of Mining Engineers. It appears that the magnetization of the lean red and brown iron ores of the South may yet become an important branch of the iron industry. If pieces of hematite ore the size of an egg are heated to redness, and then carbonic oxide or producer gas is passed over them, they become more or less magnetic, and a remarkable thing is that if only a small portion of the sesquioxide is converted into magnetic oxide, a strong magnet will remove the whole of the ore from the gangue. Works have already been erected to carry out the described process on a large scale. As an average result, fossiliferous red ore, containing 40 per cent. iron and 30 per cent. insoluble matter, was concentrated so as to produce an ore with 58 per cent. iron and 12 per cent. insoluble matter. The best result was the obtaining of one ton of concentrates from two tons of ore, and the worst, of one ton from three tons. Prof. Phillips believes the process may be commercially profitable for works on Red Mountain, Ala., where the lean ore can be quarried and delivered to the magnetizing kilns for 25 cents per ton, if only one ton of concentrates is obtained for every three tons mined. *Industries and Iron*, Nov. 1, '95.

Some Points Connected with the Preparation of Pure Iron by Electrolysis. By Prof. W. M. Hicks, F. R S., and L. T. O'Shea, B. Sc. Read before the British Association. The authors of this paper have carefully studied the history of the subject and found that in their actual practice a number of difficulties presented themselves which they found unmentioned so far. In order to give

their successors the benefit of their experience, they brought out this paper, which is reprinted in *Elec. Review*, Nov. 13, '95.

Leclanche Primary Cell and its Modifications. By J. Warren. Writer gives a description of two dry cells which are modifications of the Leclanche type. *London Elec. Engineer*, Nov. 15, '95.

Application of Electricity to the Sewage Problem. Professor John W. Langley has been conducting elaborate experiments, and at the Cleveland Council of Sociology read a paper, the principal points of which are reprinted in *Electricity*, Nov. 20, '95.

Development of the Electro-Deposition of Gold in the Transvaal. By Emile Andreoli. A summary of the works and their capacities, using the Siemens process. *London Elec. Review*, Nov. 22, '95.

Aluminium Solders. By Joseph Richards. Paper read before the Franklin Institute. After a review of the work done in this direction, author enumerates the following requirements for a good solder: 1. It must wet the aluminium and adhere firmly. 2. It must not disintegrate after exposure to the air. 3. It must be as malleable and strong as aluminium. 4. It must have a low melting point, so as to be easily worked with a soldering iron. 5. It must have the same color as aluminium, and not change color. 6. It must be cheap enough for general use. He then gives a composition which he has found by experiment to be fairly satisfactory. *Practical Engineer* (London), Nov. 22, '95.

Production of Pure Zinc. By Mylius and Fromm. To try to purify zinc by dry methods leads to no favorable results. The wet process can be carried out only with the aid of electrolysis, and this can be done in two ways—by the deposition of the metals from purified solutions with insoluble anodes, or by electrolytic refining with the use of soluble anodes of zinc. In their researches they used pure solutions of sulphate of zinc, and obtained the following results: The pure zinc of commerce contains in all cases noticeable quantities of cadmium, lead and iron. A solution of sulphate of zinc can be purified electrolytically so that chemical analysis cannot find any heavy foreign metals; zinc oxide is easily obtained by a chemical process, with the same purity; the electrolytic zinc obtained from zinc sulphate or oxide contains appreciable quantities of platinum which comes from the anode; the purest zinc is obtained by the repeated electrolytic reduction of the metal in basic zinc sulphate solutions, from which it is obtained in a spongy state, and must be melted in vacuum. The metal so obtained is not absolutely pure, but contains at least 99.99 per cent. of zinc. With the electrolytic decomposition of zinc the secondary decomposition of water cannot be prevented entirely. The formation of spongy zinc takes place by the action of the oxygen. *Electrochemische Zeitschrift*, Oct., '95; abstract in *London Elec. Engineer*, Nov. 29, '95.

Which Electrolytic Methods Can Be Used with Advantage in Analytical Practice? By Dr. Bernhard Neumann. From the *Zeitschrift für Elektrochemie*, No. 11, 12 and 13. A very extensive article, too long to do it justice in a short review; it is practically

an encyclopedial article on the subject and is given in a five column abstract in *London Electrician*, Nov. 29, '95.

Electroplating Ships. By this new process of electroplating, the copper, it is claimed, becomes practically a part of the steel plate when completed. The copper is applied to the completed vessel and not to the separate plates, and hence existing vessels may take advantage of this method to save dockage. *Elec. World*, Nov. 30, '95.

On the Production of Bleaching Fluids by Means of Electrolysis of Common Salt Solution. By V. Engelhardt. Writer mentions that the electrolysis of common salt can be carried out from three different points of view. 1. Production of a bleaching fluid consisting of hypochloride of soda, besides undissolved common salt. 2. Separate production of sodium and chlorine. 3. Production of chlorate. In the present paper, the first of these is treated. *Elektrotechnischer Anzeiger*, Dec. 8, '95 ; *Electrochem. Zeitschrift*, Dec., '95.

An Electrolytic Process for the Manufacture of White Lead. By R. P. Williams. Paper read before the Am. Chem. Society, Springfield. Describing a new process invented by Arthur Benjamin Brown, a chemist and mining engineer of Boston. *Scientific American Supplement*, Dec. 14, '95.

Electrolysis Prevention at Newark, N. J. By Harold P. Brown. A successful experiment described in *St. R'y Review*, Dec. 15, '95.

On the Simultaneous Production of Zinc and Lead. Description of an electrolytic method. *Elektrotechn. Anzeiger*, Dec. 19, '95.

ELECTRO-PHYSICS.

Experimental Investigation into the Origin of Frictional Electricity. By C. Christiansen, in *Wiedem. Ann.*, 53, p. 401, '94. Translation in *London Elec. Review*, Dec. 21, '94; *Elec. Age*, Jan. 19, '95.

What is Electricity? By Mr. Sydney F. Walker. The writer's opinion is that electricity is a mode of motion, just as heat, light and sound, but at a different rate. He refers to Prof. Hertz's work and urges that such experiments be continued. *Am. Gas Light Journal*, Jan. 7, '95.

Modern Theories as to Electricity. By Henry A. Rowland. Starting with the old theories, the writer points out that electricity no longer exists, but rather electrical phenomena, electric waves, etc. He then goes into a short discussion of Faraday's tubes of force and finally reduces the theory of electricity and magnetism to the theory of the ether. The paper ends with an investigation of what the ether must explain in order that we may, if possible, imagine its nature. *Engineering Magazine*, Jan.; *Am. Gas Light Journal*, Jan. 16, '95.

Researches Relating to Electro-Magnetic Oscillations. A short review of the work done by Prof. Minchin in this line of research is editorially treated in *London Elec. Review*, Jan. 25, '95.

The Distribution of Energy in the Spectrum of the Glow Lamp. By Edward L. Nichols. *Physical Review* and *Electricity*, Jan. 30, '95.

On the Units of Light and Radiation. By A. Macfarlane, D. Sc., LL.D. A paper read before the Am. Inst. of Elec. Eng's, Jan. 16th, appeared in *Electricity*, Jan. 30, '95; *Elec. Review*, Jan. 30, '95.

Electric Discharge through Gases. By Prof. J. J. Thomson, F.R.S. Paper read before the Royal Institution of Great Britain. The writer discusses, first, some phenomena connected with the passage of electricity from the gas to the electrode, or from the electrode to the gas; and secondly, some of the properties of the discharge when its course lies entirely in the gas. *London Elec. Engineer*, Feb. 1, '95.

Tœpler's High Frequency Experiments. Dr. Tœpler, of Dresden, the inventor of a well known type of the influence machine, has recently succeeded in reproducing most of Tesla's experiments with two large multiple influence machines, one of 20 plates, and the other of 60 plates. Tesla's experiments, by which he showed that disconnected vacuum tubes placed in a space agitated by the high frequency waves can be illuminated, may also be shown by Tœpler's apparatus; also all the phenomena of the so-called Crookes's tubes, such as phosphorescence, fluorescence, etc. The

effects obtained by Tœpler with the large multiple plate influence machine were much greater, in proportion to the horse-power expended, than those obtained with an alternating current dynamo. *London Elec. Review*, Feb. 1, '95.

Prof. Rowland on Modern Theories of Electricity. By Prof. Oliver Lodge, F.R.S. From *London Electrician*, in answer to Prof. Rowland's paper, which appeared in the *Engineering Magazine*, and which was referred to in Synopsis of our previous issue. *Electricity*, Feb. 6, '95.

Electrical Consonance. By M. I. Pupin, Ph. D. The self-induction of a circuit may be neutralized and a large current produced in it by a given impressed electromotive force, although the natural period of the circuit is not the same as that of the impressed electromotive force. This will happen, just as in the case of sound, when the circuit is electro-magnetically connected to another secondary circuit capable of electrical vibrations. The name of electrical consonance might well be applied to phenomena of this class. The writer discusses a case of this kind mathematically in *Elec. World*, Feb. 9, '95.

The Future of Electricity. By Sydney F. Walker. From the *London Elec. Engineer.* A popular article on the possibilities of electrical discoveries and inventions. *Electricity*, Feb. 13, '95.

On Experiments with Tesla Currents. By F. Thinstadt. The writer has reproduced a number of Tesla experiments with very simple apparatus, which he describes in "*Wiedemann's Annalen*" and which are given in abstract in *Elec. Review*, Feb. 20, '95.

Action at a Distance. By Max Osterberg. A popular treatment of the development of this theory, with the explanation of the work done by Faraday, Maxwell and Hertz. ELECTRIC POWER, March, '95.

Atmospheric Electricity. By Prof. Schuster. A lecture delivered before the Royal Institution. Deals in a very interesting manner with modern views, and gives quite a number of experiments supporting theory. An interesting diagram is shown, illustrating reversal of lines of force due to dust storms. *London Elec. Review*, March 1, '95.

Electrical Consonance. By Chas. Proteus Steinmetz. The writer wishes to explain the phenomena of electrical consonance pointed out for the first time by Prof. M. I. Pupin in a different way. *Elec. World*, March 2, '95.

The Study of Atmospheric Electricity at Sea. By Prof. W. F. Magie, in the *American Meteorological Journal.* The writer concludes that an isolated light house would be the most perfect place to make delicate observations. *Elec. Review*, March 20, '95.

Silvering Mirrors. A recent number of *Zeitschrift fuer Angewandte Chemie* contains a very interesting paper on silvering mirrors by the use of a silver solution. Description of the Brashear process is given in *Am. Manufact. and Iron World*, March 22, '95.

Electromotive Force of Magnetization. A short abstract of the researches of Mr. Hurmuzescu. *L'Electricien*, March 9, '95.

Propagation of Variable Currents in Conductors. By M. Lamotte. Reviews the various equations enunciated by Kirchhoff, Neumann, Stefan, Weber and Maxwell. *L'Eclairage Electrique*, March 9, '95.

Electric Currents of High Pressure and Periodicity. By A. A. C. Swinton. Contribution to the professional papers of the Corps of Royal Engineers, Cheatham. The experimental effects which the author shows are produced by utilizing the disruptive discharges of Leyden jars to give electrical impulses of comparatively considerable magnitude as regards energy, but of exceedingly short duration as regards time. *London Elec. Engineer*, March 22, '95 ; *Electricity*, April 10, '95.

Microscopical Research on the Electrostatic Discharge. By George T. Hanchett. An investigation of instantaneous effects by means of photography. *Elec. World*, March 30, '95.

Velocity of Electric Waves. By J. Trowbridge and W. Duane. The authors increased the size and changed the shape of an ordinary Hertz vibrator until the period of oscillation was sufficiently long to be determined by photographing the spark ; measured the length of the waves induced in a secondary circuit tuned to resonance with the vibrator ; the quotient of the wave length by the tune of a complete oscillation will be the required velocity. *Am. Journal of Science*, April, '95.

On the Diselectrification of Air. By Lord Kelvin, F. R. S., Magnus Maclean, M. A., F. R. S. E., and Alexander Galt, B. Sc., F. R. S. E. A paper read before the Royal Society, March 14, '95. Experiments made prove that air electrified negatively by bubbling through water and caused to pass through a metallic wire gauge strainer gives up some of its electricity to the metal. Such terms as "voltaic electricity," "frictional electricity," "thermo-electricity," etc., are ill-chosen and convey the idea that there are different kinds of electricity. "Thermo-electromotive force" is, I would suggest, a good substitute for the term "thermo-electricity." The same with "pyro-electricity" and "piezo-electricity" and the like. "Thermo-battery" is better than "thermo-pile," and so on. *London Elec. Review*, April 5, '95.

Foucault Currents. By P. Janet. The distribution of induced current in three dimensional conductors is discussed in this paper. Writer refers to the works of Kirchhoff, Helmholtz, Maxwell and Hertz. After an introductory section he treats the vector potential at a point of the cylindrical conductor, and then takes up the specific intensity of the current at any point of that conductor. *L'Eclairage Electrique*, April 13, '95.

The Magnetic Needle. By Vaughan Cornish, M.Sc , F. R. S. A short article, written in popular and simple style. *Scientific American Supplement*, April 27, '95.

The Deflection of the Magnetic Needle. By Captain J. H. Malet. As early as 1819 Arago said: "Auroras ought to be placed in the first rank among the causes which sometimes disturb the regular march of the diurnal changes of the magnetic needle." Dr. Robinson in 1858 discovered that the light of the aurora possesses, in a peculiar degree, a property termed fluorescence, which is a recognized and characteristic property of the light produced by electrical discharges. *Scientific American Supplement*, April 27, '95.

Waves and Vibrations. In the concluding lecture of the series, Lord Rayleigh showed that sensitive flames were responsive to vibrations of high frequency. A sensitive jet could, however, be obtained by allowing a solution of potassium permanganate (ordinary Condy's fluid) to pass through a nozzle into a vessel containing acidulated ferrous sulphate. By this means the effects are rendered more manageable than with jets in air, and we obtain a response to vibrations having 10 to 20 periods per second, compared with which sensitive flames are most sensitive to periods more like 2,000 per second. With high pressures on the gas producing the flames, the pitch to which the greatest response is obtained becomes higher still. *London Elec. Review*, May 10, '95,

High Frequency Lamps. A short review of Ebert's work on Tesla frequencies. This article, though short, is written in clear style and gives a good idea of the high frequency discharges. *Die Elektrizität*, May 11, '95.

Electrodynamics of Bodies in Motion. By H. Poincaré. Discussion of the theories of Larmor, Helmholtz, Lorentz and J. J. Thomson. *L'Eclairage Electrique*, May 18, '95.

A New Optical Method for Measuring Alternating Currents. By J. Pionchon in *L'Électricien*. 1. Determination of frequency; 2. Determination of maximum intensity; 3. Determination of curve showing intensity. *Elektrotech. Anzeiger*, May 19, '95.

Recent Experiments on the Electric Discharge. By Lord Armstrong. At one of the conversaziones of the Royal Society, Lord Armstrong exhibited on the lantern screen a remarkable series of photographs and dust figures produced by the action of very powerful electric discharges. Most of the effects were obtained by the use of a large multiple Wimshurst machine, having 16 plates of 34 inches diameter, and capable of giving a spark of about 17½ inches. The machine was fitted with two 10-gallon Leyden jars, as condensers, and was found perfectly adapted for the purpose of the experiments. The photographs were mostly obtained by the well-known method of causing the discharge to pass over the surface of a photographic plate with which the electrodes had been placed in contact. The dust figures were produced by discharging on glass or metal plates over which had been sifted various more or less non-conducting powders, such as calcined magnesia, mixed with carbon in the form of lamp-black, tripoli powder and hard carbon reduced to a fine powder. Illustrations and descriptions in detail appeared in *London Elec. Review*, May 24, '95.

On the Electrification of Air. By Lord Kelvin, F.R.S. Communication to the Philosophical Society of Glasgow. *Science*, May 31, '95.

Light and Electrification. By Oliver J. Lodge. From *Science Progress.*

If an ordinary gold leaf electroscope with a freshly scraped zinc cup or knob, is charged with negative electricity, and is then exposed to the unfiltered rays of a source of ultra violet light, its charge will leak away rapidly. If, further, the electroscope so treated be extremely sensitive, it will be found not only to lose its negative charge, but to acquire a slight trace of positive charge under the action of light. Writer gives a summary historical sketch, experiments, details, influence of the kind of metal, plants, effects of magnetism, etc., in *Scientific American Supplement*, June 22, '95.

Condensation of Fumes by Static Electricity. By Malvern W. Iles. Writer gives a short review of the history of this subject and thinks that if there can be discovered some cheap mode for the generation of static electricity, that it will enable the metallurgist to save a very large amount annually in all the well known volatile metals. *School of Mines Quarterly*, July, '95.

A Singular Effect of Lightning Stroke in Chicago. By W. M. Stine. Writer describes some effects on the electric light wires of the factory building of the Illinois Industrial Home for the Blind, caused by a stroke of lightning. *Elec. Engineer*, July 10, '95.

Vibrations. By A. E. Dolbear. Writer discusses the effect on living beings of waves of widely different period. One of the conclusions is that the human body may be affected by waves of which it has no sensation, owing to an absence of a nervous organization of detecting their influence. *Elec. World*, July 13, '95.

The Counter Electromotive Force in the Electric Arc. By W. H. Freedman, E. E. There having been for a long time considerable discussion and difference of opinion regarding the counter electromotive force of an arc, an experimental investigation was undertaken with the hope of throwing some light on the subject. From these experiments we can now conclude: 1. There is a counter electromotive force present in an electric arc, depending simply upon the material of the electrodes and the temperature of volatilization of that material, and this counter electromotive force has a constant definite value for that material. 2. On account of the different temperatures there must be a thermo-electric effect. That is: there is a thermo-electric couple of the material of the electrode and of its vapor whose junction is at a much higher temperature than the rest of the circuit. 3. It is fair to assume that two amperes of current will tear off twice as many molecules, in the same length of time, from the positive electrode as one ampere; in strict analogy to electro-deposition. ELECTRIC POWER, August, '95.

On the Electrolysis of Gases. By J. J. Thomson, F.R.S. Paper read at the Royal Society. Copied from *Nature*. In the experiments described in this paper, Thomson used the spectroscope to

detect the decomposition of gases by the electric discharge and the movement of the irons in opposite directions along the discharge tube. The method consists in sending the electric discharge through a tube so arranged that the spectra close to the positive and negative electrodes can easily be compared. The method is, however, only qualitative. *Scien. Am. Supplement*, Oct. 19, '95 and subsequent issue; *London Electrician*, Aug. 30, '95.

A Magnetic Potential. By Frederick Bedell, Ph.D. An analytical discussion of the subject. *Physical Review* and *Elec. Review*, Sept. 11, '95.

On Apparent Attractions and Repulsions of Electrical Conductors in a Dielectric Fluid. By M. Gony. Concerning attractions and repulsions, author remarks that hydrostatic pressure plays an essential part in electrical contraction. *Bull. de la Soc. Internationale des Elec.*, Oct., '95.

Theory of Larmor. By H. Poincaré. Discussion of Hertzian theory and conclusions. *L'Eclairage Electrique*, Oct. 5, '95.

Action of the Electric Current Upon Aluminium Wire. By Chas. Margot. Some simple experimental results described in *Scien. Am. Supplement*, Oct. 5, '95.

Apparatus for the Demonstration of the Development of Heat in Wires by Electric Oscillations. By Ignaz Klemencic. From *Wied. Ann.* No. 4, '95. Translated in *London Electrician*, Oct. 18, '95.

Double Refraction of Electric Rays. By Peter Lebedew. Author has successfully generated and observed waves which could only be measured by fractions of a centimetre and which came nearer the longest waves of the heat spectrum than the electrical waves originally employed by Hertz. Description of apparatus and repetition of Hertz's experiments are described in *Wiedemann's Annalen*, Nov. 9, '95, and *London Electrician*, Nov. 15, '95.

Researches of M. O. Lehmann on Electrical Discharge of Gases. By M. Lamotte. After a summary of Lehmann's work, the writer gives the conclusions arrived at. *L'Eclairage Electrique*, Nov. 23, '95.

Loss of Energy in Dielectrics. Mr. Gassnier gives a good summary of the results obtained by a number of scientists to prove or disprove the existence of a dielectric hysteresis. It has been found that besides the loss in a condenser, due to conduction, there is another and larger loss which is of a different nature; Steinmetz measured the loss for a paraffined paper condenser of three microfarads with a current of 170 periods, finding that the loss is 12 times that produced by a continuous current, and that this loss increased with the square of the voltage. Arno made an experiment which he believed showed a dielectric hysteresis of two kinds, one depending on time, and the other being analogous to magnetic hysteresis; Northrup found a difference of three per cent. for paraffine between a small varying field and a rapidly varying field, and for glass 6.2 per cent.; Janet attributed his results to a true hysteresis and a viscous hyster-

esis. On the other hand, Hess believes to have proved that the losses noticed can all be shown to be due to conduction; Boral came to the same conclusion, while Porter and Morris believe to have shown that the losses are due to viscous effects and not to hysteresis; Benischke found no increase in temperature in a paraffined block, and concludes that there is no hysteresis, believing that the losses are due to the formation of residual viscous effects, to Joule effects, and to mechanical vibrations of the parts of the condenser; Eisler believes the losses are attributable to viscosity, and that for a certain frequency this would be a maximum. It follows from all these experiments that the existence of a dielectric hysteresis, analoguous to magnetic hysteresis, cannot yet be considered as having been demonstrated, and that it may therefore not exist; there remained two hypotheses, one of a viscous hysteresis and the other of interior conduction. *L'Industrie Electrique*, Oct. 10, '95, and the above from *London Electricity*, Dec. 15, '95.

Existence of Vertical Earth-Air Electric Current in the United Kingdom. By Prof. Rucker. Author concluded that in the United Kingdom there is no vertical current amounting on the average to 0.1 ampere per square kilometre. *Physical Society*, London.

ELECTRO-THERAPEUTICS, DIAGNOSIS, ETC.

Researches into the Electromotive Phenomena of Physiology. A review of experiments made and conclusions arrived at by several physicians, and principally the work done in that line by Mr. E. Waymouth Reid. Mr. Reid's original paper is to be found in *Science Progress*, and abstract in *London Elec. Review*, Dec. 28, '94.

Electrical Sanitation. A review of the Hermite process of electrical sanitation given in the consular report of C. W. Chancellor, United States Consul at Havre, France. *Elec. Age*, Dec. 29, '94.

Electrical-Medical Apparatus. By Harry F. Waite. Description of a medical coil and static apparatus, and illustrations of various coils and induction machines. *Elec. World*, Jan. 26, '95.

The St. Louis Electric Ambulance Car. A description of the interior of the car. *Western Electrician*, Feb. 2, '95.

Does Execution by Electricity, as practiced in N. Y. State, produce Instantaneous, Painless and Absolute Death? Observations made at the execution of David Hampton, at Sing Sing, Jan. 28, '95. By A. E. Kennelly and Augustin H. Goelet, M. D. The authors think that there is no hope of resuscitation in cases where, as in this electrical execution, an alternating current of sufficient E. M. F. is deliberately sent through the body of the criminal. *Elec. World*, Feb. 16, '95.

First Aid in Electric Accidents. By W. S. Hedley, M. D., in "*London Lancet.*" In considering alternating vs. direct currents, it says: The Board of Trade regulations, as well as the rules of the fire insurance offices, seem to point to the fact that the alternating current is more dangerous than the direct, inasmuch as while the constant current is allowed to enter a house at 300 volts, the pressure of the alternating is limited to 150. This seems to imply that the latter current is considered twice as dangerous to life as the former. If, however, it be remembered that the body is an electrolytic conductor, and that electrolytic conduction is invariably accompanied by decomposition, and further, that the living body not being homogeneous in its elements, and each different tissue thus forming a point of entry and exit of the current with the electrolytic phenomena, it is obvious that a constant current of high voltage will, on account of its electrolytic effects in the interior of the tissues be more dangerous to life, and its effects more difficult to recover from, than is the case with a current of an alternating character. Amongst the currents of commerce met with in this country are to be found constant currents having a pressure of 1,000 volts. *Elec. Review*, Feb. 20, '95.

Truth and Falsehood as to Electric Currents in the Living Body. By Victor Horsley, F.R.S., F.R.C.S., etc. London Institution lecture. The lecturer relates what is actually known concerning the existence of electrical currents in the living body that is occurring as phenomena of life. He then showed experiments to illustrate the influence of electrical effects upon the body. *London Elec. Review*, March 1, 95.

Electrical Execution. Dr. Augustin H. Goelet gave an account of his observations at an electrocution, and read the report of Dr. T. E. Oertel on a microscopical examination made of the blood and tissues of the executed criminal. The deductions drawn by Dr. Oertel, are these: 1. The chief action of the electric forces is upon the blood and the blood vessels. 2. The red blood corpuscles have less power of resistance to this force than have the white ones. 3. That one or more of the elements, the presence of which is required for the evagulation of the blood, is by the electric force changed or destroyed. 4. Some germicidal agent formed in the blood, precluding the continued existence and multiplication of putrefaction organisms. 5. The liver seems to be the organ, of those examined, most susceptible to the force exerted. 6. Of the organs examined, the lungs offered the most resistance to the force in question. 7. The force exerted is sufficient to rupture the brain tissues and the smaller vessels of the brain, thus producing universal hemorrhages in its substance. 8. No destruction of the cellular tissues seems to have been produced. 9. The deviations from the normal conditions, as noted, are sufficient to produce a lethal result. *Elec. World*, March 16, '95.

First Aid to the Electrically Shocked. The rules prepared by the French Minister of Public Works under expert advice, are given in full in *Scientific American*, March 23, '95.

Dynamic Apoplexy. By J. Mount Bleyer, M.D., F.R.A.M.S. The true cause of death by electrification as carried out by the prescribed laws of the State of New York, is due to dynamic apoplexy.

Therapeutic Action of High Frequency Currents. (D'Arsonval's self-conduction.) Note presented to the Académie des Sciences, March 18, '95, by Apostoli and Berlioz.

2,446 experiments were made. The following are some of the results achieved:

(*a*) *Negative results.*—Certain forms of hysteria and of localized neuralgia, such, for instance, as neuralgia of the radial type, proved absolutely refractory and derived no benefit from this treatment.

(*b*) *Positive results.*—The greater number of patients that derived a marked benefit from this treatment were those suffering from nutritive disorders, arthritis, gout, rheumatism, glycosuria, etc.

Nearly all of those showed a marked improvement; but those who derived the greatest benefit were arthritic subjects with articular or neuralgic symptoms. During the first trials, even before an apparent local influence or action on the urinary secretion was observed, the general health seemed to be beneficially influenced, and we noted from day to day the following general symptomatic im-

provements, making allowances for the slight differences of each particular case: Restoration of strength; return of appetite; return of sleep; increased cheerfulness and energy for work; the quieting of certain nervous symptoms; more ease in walking, appearance improved, etc. Subsequently, local troubles, either painful or involving loss of power, were gradually amended; thus a patient, who had been reduced to almost complete powerlessness by coxofemoral arthritis, regained the use of her legs. Another who had been, through sharp pains, unable to close her hand, completely regained the use of it, etc.

Rev. Internationale de l'Electricité, and *London Elec. Review*, May 24, '95.

Some Physiological Effects Experienced in Contact with Live Alternating Current Circuits. By Ludwig Gutmann. The writer has experienced a very severe shock and explains his sensations as he remembers them. ELECTRIC POWER, May, '95; copied in *Elec. Review*, June 5, '95.

An Electro-Medical Plant. By W. H. Freedman, E. E. A plant now in successful operation for about six months, consisting of dynamo and specially designed apparatus, which removes all uncertainty of operation and reduces maintenance to a minimum.

The plant supplies the demands for three separate departments: 1st. Department of diseases of women; 2nd. Department of diseases of nose and throat; 3rd. Department of nervous diseases.

Described in detail in ELECTRIC POWER, June, '95.

Cause of Death in Electric Shock. By A. M. Bleile, M.D. Paper read before the Am. Inst. of Elec. Engineers, June 27, '95. The work was undertaken with a view to elucidating the effects of larger quantities of electricity on the organism. Incidentally the value of artificial respiration after death by electricity was also tested. *Western Electrician*, July 20, '95; *Elec. Review*, July 10, '95; *Elec. Engineer*, July 3, '95.

Respiration, Suffocation and Resuscitation. By J. Mount Bleyer, M. D. The main physiological factors which play the role in respiration, suffocation and resuscitation and the author's method of pneumatic artificial respiration. *Elec. Review*, August 21, '95.

Cataphoresis and Solutions of $H_2 O_2$ for Bleaching Teeth, etc. By William J. Morton, M. D. Writer first explains cataphoresis and then notes the points to be observed in order to secure successful electric medicamental diffusions. He then makes a number of experiments from which he draws the following conclusions:

1. Cataphoric action is a demonstrable property of the galvanic or continuous current. 2. The negative pole must be placed at some part of the body comparatively distant from the tooth, for instance, the cheek, hand, back, or breast. 3. The pulp canals, if exposed, should be closed by a non-conducting cement. 4. Solutions for cataphoric action should, if spirituous, aqueous, or with glycerol, be associated with some substance which makes them better conductors of electricity. 5. One experiment teaches this most important fact, namely, that while ethereal solutions of $H_2 O_2$ do not

conduct electricity, and cannot, therefore, be used by themselves for cataphoric action, still this effect can be readily obtained when the porous material which holds such an ethereal solution has been previously moistened with a solution of sulphate of soda or some similar conductor. 6. The efficiency of bleaching agencies, as, for instance, $H_2 O_2$ solutions, is greatly enhanced by the concomitant aid of electricity, namely, by cataphoresis. *Electricity*, Aug. 21, '95.

An Electric Pressure Sound for the Direct Vibration of the Membrana Tympani. By John C. Lester, A.M., M.D., in the *New York Medical Journal.* Copied in *Elec. Review*, Sept. 4, '95.

Direct Current Dynamos for Therapeutic Purposes. A small machine with four armatures and one shaft is described. It is practically a motor-dynamo, the motor part working on the 110-volt circuit, and the three other armatures to generate 750, 1,500, 3,000 volts respectively. *Electrotechnische Anzeiger*, Sept 15, '95.

Electricity as the Medium of Transmission in the Brain. By S. Millington Miller, M. D., in the *New Science Review*, and copied in *Elec. Review*, Sept. 18, '95.

ISOLATED PLANTS.

Some Hints on the Building of Electric Plants. By Chas. G. Armstrong. This is to be a series of five articles in which the writer will discuss the following distinct stages: 1. The Inquiring Stage; 2. Specifications; 3. Installation and Construction Period; 4. Test and Final Acceptance; 5. Operation. *Elec. Industries*, Dec., '94. In the second article the writer says, that a specification should contain a synopsis of what the plant is to be, a clear statement of the number, size, kind of dynamo, etc. Too minute a specification should be avoided. The writer then goes into a careful consideration of the parts of a plant which require definite specification. *Elec. Industries*, Jan., '95.

Generating Electricity by Windmills. By I. N. Lewis. After a short history of the development of the windmill in this particular connection, Mr. C. F. Brush's plant is described and after this an analysis of the various parts constituting such a plant is given. *Am. Gas Light Journal*, Dec. 10, '94, from *Engineering Magazine.*

Electric Lights and Power in Boston's State House Extension. Plant consists of four units 180 H. P. each, direct connected dynamos, two to each engine (50 kilowatt each). Total capacity over 7,000 lights. *Elec. Review*, Dec. 12, '94.

Lighting of the Cook County Criminal Court Building, Chicago. Illustrated description. *Western Electrician*, Dec. 29, '94.

Some Hints of the Building of Electric Plants. By Chas. G. Armstrong. The third of a series of articles, previously referred to in the Synopsis, treats the "Construction Period." *Elec. Industries*, Feb., '95.

Electric Illumination in the Railroad Depot at Argentenil-Triage, with plan of depot. *L'Électricien*, Feb. 2, '95.

Electric Car Lighting System on the New York and Brooklyn Bridge Railway. Current for the lamps is supplied by means of the overhead trolley. A detailed description, with a number of illustrations, is to be found in *St. R'y Gazette*, Feb. 2, '95; *Elec. Review*, Feb. 6, '95.

Electric Plant in the New Planters' Hotel, St. Louis, Mo. One 160 horse power engine coupled direct to one eight-pole direct current 100 kilowatt generator, at 275 revolutions. Two 135 horsepower engines direct connected to two 75 kilowatt generators; and one small engine and dynamo to carry the day load. Building is wired for 4,000 110 volt incandescent lamps.

A Private House Lighting Plant. A plant which has been selected, not that it presents any very novel features, but because it

is a good example of the arrangement of plant suitable for the electric lighting of a country house. *London Elec. Engineer*, March 8, '95.

A Compact Isolated Lighting Plant. Description of a 400 light capacity plant which occupies but a small corner in an engine room of a factory. *Elec. Industries*, March, '95.

The Prudential Assurance Company Electric Light Plant. An illustrated description of plant. (London) *Lightning*, March 14, '95.

An Electric Power Distribution and Lighting Plant. An illustrated description of the Illinois State Penitentiary Central Power Station. *Elec. Industries*, April, '95.

Electricity at the New York Navy Yard. Description of plant. *Elec. World*, April 6, '95.

Storage Batteries in Maywood. The successful operation of the storage battery locomotive installed last year in the tinplate factory of Norton Bros's company, in Maywood, Ills., induced Edwin Norton, the Vice-President of the company to use current from the dynamo plant at the factory, conveying the current to a storage battery located at his residence. Complete description in *Western Electrician*, April 6, '95.

Boston Public Library. By W. S. Key. Various devices of interest to the engineer are described, as for example the book carrier service, ventilation, lighting plant, switchboard, wiring and fixtures, steam plant and boilers. *Elec. Engineer*, June 5, '95.

Electrical Plant of the New State House of Massachusetts. By W. S. Key. Description of the lighting, heating and ventilating plants. *Elec. Engineer*, July 10, '95.

Electrical Equipment of Public Docks. The Public Docks Stock Company, of Copenhagen, was recently confronted with the interesting problem of installing an electric light and power plant on their projected docks. A detailed description of the same appeared in *Elec. World*, Nov. 9, '95.

Electric Lighting Plant of the American Tract Society's Building. Plant derives its power from two 125 H. P. water tube boilers, banked into a battery, and one 250 H. P., worked singly. Plant averages six tons of coal for 10 hours; slow-speed multipolar generators are used. Three units, one of 100, one of 50, and one of 25 K. W. are installed. Switchboard is divided into three large panels: two side panels for ordinary circuits and a centre panel. *Elec. World*, Dec. 7, '95.

Some Notable Isolated Electric Lighting Plants. The New Hoffman House and Grace Church Chapel and Mission Building. *Electricity*, Dec. 25, '95.

LIGHTING.—ARC AND INCANDESCENT LIGHTS.

Electric Lights and Power in Boston's State House Extension. See under "Isolated Plants."

The Auer-Welsbach Burner. In our issue of September, 1894, page 324, the compiler of this synopsis referred to the Welsbach burner as being in competition with the incandescent lighting. The subject has since been discussed editorially and in "letters to the editor" in several papers, to wit: the *Elec. Engineer*, *Electricity*, etc.

Continuous and Alternating Current Arcs. By Prof. J. A. Fleming, F.R.S. In this paper which appeared originally in *Lightning*, London, Prof. Fleming gives the results of experiments made in 1890, when he compared the mean spherical candle-power of alternating with continuous current arc lamps, and found that the ratio in favor of the continuous current was about as 3 to 2, which, of course, does not debar the possibility of improvement on arc lamps. ELECTRIC POWER, Dec., '94.

Illumination by Arc Lamps. A comparison between arc and incandescent lighting. Comparative figures for cost, candle-power, etc. *Der Techniker*, Dec., '94.

Distribution of Light from Arc Lamps. By Rankin Kennedy. From the *London Elec. Review*. Different methods of applying reflectors to bring about efficient and even distribution. *Elec. Engineer*, Dec. 5; *Elec. Age*. Dec. 8; *Am. Gas Light Journal*, Dec. 17, '94.

Lighting Installations. By H. A. Henderson. Read before the Northern (British) Society of Electrical Engineers, November 12, 1894. Following the proverb: "Let well enough alone," Mr. Henderson does not consider the good installations, but rather the bad ones and points out wherein the principal difficulties lie: 1. Bad Supervision; Principal Result: Bad Joints in Wiring. 2. Employment of Inefficient Labor. 3. Inferior Material Used on Account of Its Low First Cost. *Elec. Review*, Dec. 5, '94.

Central Station in Frankfort-on-Main, Germany. Description in *L'Industrie Électrique*, Dec. 10, '94.

The Louisville, Ky., Electric Light Co.'s Station Extension. Illustrated description. *Elec. Engineer*, Dec. 19, '94.

The Making of an Incandescent Lamp. A complete description with many illustrations. *Elec. Engineer*, Jan. 2, '95.

The Incandescent Lamp. By Manning K. Eyre. A complete description of the lamp, with many interesting illustrations. *Elec. World*, Jan. 5, '95.

Arc Light Carbons. By B. F. Miles. After a short history of the arc light carbon, starting with Sir Humphrey Davy's experiments in 1810, and going through to the present time, the writer explains

the methods of manufacturing the carbons as they are used to-day. At present about 25 factories are in operation, with a capacity of three hundred and fifty to four hundred millions. *Elec. World*, Jan. 5, '95.

The Light of the Future. By John Gray, B. Sc. Stimulated by the successful introduction of the Welsbach burner, the writer discusses the possible chances of gas *vs.* electricity. In England the actual cost of the electric light is about 1½ times that of gas. He also speaks about the experiments of Ebert and Wiedemann, and closes with the opinion that the luminescent (Ebert) lamp will be the light of the future. *London Elec. Review*, Jan. 4, '95.

The Welsbach Gas Burner. An editorial in which the relative advantages and disadvantages of the burner with respect to the electrical incandescent lamp are pointed out. The cheapness in the use of gas is believed to be annulled by the breakage of chimneys and mantles, the disagreeable color, and the effective illumination not as great as it appears. *London Elec. Review*, Jan. 4, '95.

Illuminating Power of Electric Light Projections. By W. Tchikoleff, R. Klasson and W. Turin. An elaborate study dealing with the influence of the dimensions of the reflector, with the local distance and with the current strength. *L'Eclairage Electrique*, Jan. 5, '95.

Higher Voltage Lamps for Central Stations. By G. L. Addenbrooke. The writer points out the great advantages to be gained if we use successful 200 volt lamp *vs.* the 110—120 volt lamp. From the tables of the lighting power of lamps under different pressures, by Dr. Fleming and Profs. Ayrton and Perry, the writer has compiled the following table, which is sufficiently accurate for ordinary purposes, and is easily remembered. Taking a lamp giving 16 candles at 100 volts pressure as a basis,

If pressure is		Candle-power of lamp	
104	volts	20	candles.
103	"	19	"
102	"	18	"
101	"	17	"
100	" (normal)	16	"
99	"	15	"
98	"	14	"
97	"	13	"
96	"	12	"

London Elec. Review, Jan. 11, '95.

Train Lighting by Electricity on Danish Railways. In a paper contributed to the *Proceed. of the Inst. of Civil Eng's* (England), the author summarizes experiments on train lighting by electricity made on the Danish State Railway during the last two years. The yearly expenditure was found to be about 1.4 cents per lamp hour. *Am. Gas Light Journal*, Jan. 14, '95.

The Optical Efficiency of Common Sources of Light. By the term optical efficiency must be understood the ratio of energy expended in producing the sensation of light to the total energy dissipated in the lamp. The sensation of light is produced by such vibrations of the ether as are capable of affecting the retina, namely,

vibrations having a wave length between .00081 and .00036 of a millimetre. The optical efficiency—energy expended in producing light—of the various common sources of light is, according to the latest determinations, as follows :—

Oil lamp	.073	per cent.
Ordinary gas flame	.033	"
Incandescent lamp (electric)	1	"
Arc lamp	3.875	"
Magnesium light	15	"
Sun	31	" (about)
Geissler tube	32.7	"

Elec. Plant and *Practical Engineer* (London), Jan. 18, '95.

The Arc Light. By Prof. Silvanus P. Thompson. We give below an abstract of this lecture as it appeared in the Editorial Notes of *London Ind. and Iron*, Jan. 25, '95.

"Of the whole of the light generated, less than 10 per cent. is delivered from the peak, and the crater might be regarded as a self-luminous area. It necessarily follows that the light given off is directly proportionate to the area of crater actually exposed to view, being greatest at an angle of 40° or 50°. Professor Thompson stated that an examination of the crater by the naked eye sometimes revealed a nebulous patch, rather whiter than the rest, which seems to be in motion, and this, when examined by appropriate artificial means, is seen as a comma-shaped object, which rotates round the crater at varying speeds, and not always in the same direction. Professor Thompson also pointed out that the arc as a transformer of energy into light, gave an efficiency of only 20 or 25 per cent., the rest of the energy being transformed into heat. He demonstrated by experiment that the light from an alternate current is more equally distributed than from a direct current, but did not consider there was any difference of efficiency between the two if the same amount of energy were consumed under equal conditions."

Electrical Equipment of the "Priscilla." This is the latest Fall River line steamer, and the electrical plant on the same being of an unusual size, deserves special attention. The complete description with a number of the interior views is given in *Elec. Review*, Jan. 30, '95.

Incandescent Lamp versus Welsbach Burner. By Wm. Goetz. Paper read before the Northwestern Electrical Association, Jan. 16, '95. "This paper is written with the intention to point out to station managers and contractors some of the defects of this uninvited guest." *Elec. Review*, Jan. 30, '95.

Cost of Electric Lighting. A report of the Toronto Electric Light Company. The offer of the Toronto Electric Light Company is $74.82 per lamp per year. *Can. Elec. News*, Feb., '95.

Gas for Electric Car Illumination. A short article pointing out the various disadvantages of lighting cars from the trolley wire, and showing the advantages of gas, especially dwelling on the Pintsch light. *St. R'y Journal*, Feb., '95.

Incandescent Lighting on the Meter System, Compared with the Contract System. By G. L. Cole. Read at the meeting of the Northwestern Elec. Assoc., Jan., '95. The writer is decidedly in favor of the meter system, as experience has taught him. He claims the following points are self-evident in favor of the meter: The station receives pay for current furnished; the customer pays only for the current received; service is more satisfactory to the customer, because it is more complete, and investment under the meter system commands a larger field than is possible to obtain under the contract system. It stimulates economy on the part of the customer, and induces study on the part of the owner. The meter system is eminently fair to both parties, and soon after installation commends itself to the public. *Can. Elec. News*, Feb., '95.

Interior Lighting by Public Supply. By Howard Pentland and A. H. Gibbins. Deals with the size, insulation and resistance of the conductors. *London Electricity*, Feb. 1, '95.

The Physics of the Arc Lamp. By Prof. Silvanus P. Thompson. In his last Cantor lecture, Prof. Silvanus P. Thompson dealt further with the consideration of the physics of the arc lamp, including some points which had not been touched upon at his earlier lectures. He mentioned that if the arc is produced within an enclosed globe to which the air has not free access, the consumption of carbon is much diminished. This advantage, however, is attended with the serious drawback that a brown deposit forms on the glass, which, gradually thickening, ultimately shuts in a large portion of the light. Proceeding to the matter of irregular feeding, Prof. Thompson mentioned the causes to which this defect is chiefly attributable, and then entered with great detail into a description of the various mechanical devices used in the arc lamps to keep the carbons in their proper position, tracing the improvements which had taken place in this respect during the past six years. After explaining, with the assistance of screen photographs, the features of the chief lamps now in use, the professor expressed an opinion to the effect that, although a large measure of success had been obtained, the universal lamp, to work equally well with either continuous and alternate currents, had not yet been successfully devised. *London Industries and Iron*, Feb. 1, '95.

Electrical Search Lights and their Application during the War. An extensive study on this subject appeared in *L'Éclairage Electrique*, Feb. 2, '95.

Use of the Searchlight by the Japanese Army. An illustration which is a reproduction of a water color drawing, made by a Japanese artist, and sent to members of the Japanese colony in Chicago. *Western Electrician*, Feb. 2, '95.

The Incandescent Lamp. By Manning K. Eyre; in *"Elec. World."* A description of the manufacture of the lamp. Reprinted in *London Elec. Engineer*, Feb. 8, '95, and to be continued in subsequent issues.

Notes on Search Lights. By J. Watts. The writer finds that any source of light having appreciable dimensions compared with the

mirror cannot furnish a true parallel beam. He placed a concave lens between the arc and the mirror and found this to be a good method to concentrate a large amount of light. *London Electricity*, Feb. 8, '95.

The Electric Arc. By Hertha Ayrton. Abstract from the *London Electrician*. These papers are particularly to cover the ground which Prof. Ayrton considered at the Chicago Elec. Congress. *Elec. Engineer*, Feb. 13, '95.

An Electric Lighthouse. Description of the first lighthouse in the United States to be equipped with an electric plant, will be that at Fire Island. Illustrated description of same appeared in *Elec. World*, Feb. 16, '95.

The Early History of Arc Lighting. By Chas. F. Brush. Address delivered before the Cleveland Electric Light Convention. Some early reminiscences of arc lighting. The author points out incidentally that he first applied compounding of dynamos to plating machines. *Elec. World*, March 2, 95.

Arc Carbons and the Rating of Arc Lamps. By L. B. Marks. Paper read at the Cleveland Electric Light Convention. The inquiry as to how far the candle power produced depends upon the watts consumed, and the part played by the arc carbon in this important relation. *Elec. World*, March 2, '95; *Elec. Review*, March 13, '95.

Electric Illumination of Mail Cars. In a number of places in Germany an accumulator system has been introduced, and is said to work successfully. *Zeitschrift fuer Beleuchtungswesen*, March 15, '95.

New Alternating Current Arc Lamps. An illustrated description of a new lamp in which the carbons are steadily pushed forward. *Elektrotech. Zeitschrift*, and in abstract in *London Elec. Engineer*, March 15, '95.

Electric Signal Lamps for the Metropolitan Elevated Railroad in Chicago. The latest development is the adoption of electric lights for switch lamps, headlights, side-lights, tail-lights and classification signals of express and way trains. *Street Railway Review*, March 15, '95.

Electric Lighting of the Schoolship Conway. This little article is another addition to ship lighting. *Lightning*, March 21, '95.

Reducing the Cost of Electric Light. By N. W. Perry. The writer urges a constant load in the stations. *Engineering Magazine*, April, '95.

The Heat of the Electric Light. By C. C. Haskins. The writer calls attention to the accumulative effect of heat, pointing out that fires may be caused by paper shades surrounding lamps, since these shades being exposed to the daily heating become carbonized, and then do not require as high a heat as originally to break into flame. *Western Electrician*, April 27, '95.

The Determination of the Mean Spherical Intensity of the Sources of Light. By A. Righi. The first of a series of articles, in which the author, after a short introduction on definitions, treats the old methods for the determination of the mean spherical luminosity. *L'Eclairage Electrique*, March 2, '95.

Projecting Lamps. By E. J. Brunswick. Brequet's projecting lamp with horizontal carbons is shown in section, elevation, plan and side views, and explained in detail. *Review Internat. de l'Electr.*, March 9, '95.

Arc Lamps. By Gustave Richard. The writer gives an illustrated description of the following arc lamps: Elihu Thomson (lamp constructed for the 110 volt circuit, with 2 lamps in series); Donbrava & Donat, Brown & Offord, Andrew, Taylor, Mountain, Jones, Cooper. *L'Eclairage Electrique*, March 9, '95.

Carbon Economizer for Arc Lamps. The Hardtmuth system is illustrated and described. *L'Industrie Electrique*, March 10, '95.

Incandescent Lamps. By H. Armagnat. Standardizing lamps by means of temperature or degree of incandescence seems to the author to be preferable to the old methods of standardizing by means of amperes and volts. *L'Industrie Electrique*, March 10, '95.

Blackening of Incandescent Lamps. By G. Tolomei. Translated from *L'Elettricista*, March 1, '95. An investigation into the causes of the blackening as well as a discussion of the chemicals composing the blackening. Writer says: It is possible that incandescent carbon in a vacuum might undergo a sensible evaporation at a temperature far below its melting point. *Elec. World*, March 30, '95.

The Candle Power of Arc Lamps. Referring to an editorial of the *Engineering News*, the conclusions drawn are that the reform which seems most desirable is a reform in the rating of lamp candle power. *Am. Gas Light Journal*, April 1, '95.

Comparative Measurements of Different Incandescent Gas Lights. By Prof. Dr. W. Wedding. The author shows that the Auer lamp is far superior to the more modern lamps of Trendel, Benas, Stobwasser and Kramme. His results are based on actual photometric measurements. *Elektrotech. Zeitschrift*, April 4, '95.

Coupling of Dynamos for Arc Lighting. By W. H. Lea. The writer thinks that dynamos for arc lighting might easily be put in series, thus allowing a large area to be lighted by the same circuit. *London Elec. Engineer*, April 5, '95.

Influence of Carbons on the Candle Power of the Arc Light. By Wilbur M. Stine. The writer defends himself against an attack which had been made against him on account of some statements he made in a previous paper on this subject. *Elec. World*, April 6, '95.

Electric Lighting on the New York and Brooklyn Bridge Cars. See Synopsis of April under isolated plants, also *Elec. Engineer*, April 10, '95.

The Arc Light for Municipal Street Purposes. By I. C. Wood. The method of arc lamp suspension at present in vogue may be grouped as follows: The lamp is (1) suspended midway from a wire stretched across the street, the wire being fastened to high poles; (2) suspended from a short arm on the top of a pole in the middle of the street; (3) suspended from a long arm on the top of the pole on the sidewalk, generally at a street corner; suspended about 12 feet from the curb from the cross wire which supports the trolley wire; (5) fixed in the top of a pole, either in the middle of the street, or (6) fixed in the top of the pole on the sidewalk.

The author discusses: which is the best method? and then discusses how to get rid of arc lamp shadows. *Elec. Engineer*, April, 10, '95.

Manufacture of Incandescent Electric Lamps. This article with illustrations is published for the purpose of giving to the general reader a knowledge of how incandescent lamps are made. The sketches were taken from the Swan Lamp Manufacturing Company in Cleveland. *Scientific American*, April 13, '95.

Classification and Selection of Lighting Systems. By Prof. Francis B. Crocker. The author distinguishes four questions: 1. Central stations and Isolated Plants; 2. Incandescent and arc lighting; 3. Alternating and direct current; 4. high and low potential. *Elec. Engineer*, April 10, '95; continued April 17, '95.

Reducing the Cost of Electric Lighting. Reference is made editorially to Mr. N. W. Perry's article, which appeared in the *Engineering Magazine* in April. *London Electrical Review*, April 19, '95.

Electric Lighting on Trains. By R. W. Weeks. The requirements of a perfect train-lighting system are as follows:

(*a*) The arrangement and subdivision of the light in the compartments should be convenient, and the candle-power sufficient to enable current literature to be read anywhere in the compartment.

(*b*) The voltage of supply must be steady, whether the train is running or not.

(*c*) Each individual carriage should contain its own source of electrical energy, to enable the train to be uncoupled anywhere or a carriage to be slipped.

(*d*) If the driving power for the dynamo is obtained from the axle of the carriage, the subsidiary apparatus to ensure constant potential at all speeds should be as simple as possible, and easy of adjustment and repair.

(*e*) All mechanical parts should be strong, and capable of standing vibration.

(*f*) The first cost should be reasonable.

(*g*) The working cost should compete with rival illuminants.

The systems of electrically lighting of trains can be classified as follows:

(1) Lighting from accumulators placed in each carriage which are charged from a dynamo in the guard's van, which is driven from the axle of the carriage.

(2) Accumulators only, which are recharged at the end of the journey *in situ*, or removed and replaced by other charged cells.

(3) Direct lighting from a coupled plant, consisting of dynamo and high-speed engine supplied with steam from the locomotive boiler.

Writer proposes to describe with sketches and diagrams examples of these various systems and their many variations, and, finally, to draw conclusions as to the direction in which the figures obtained from actually working them tend. *London Elec. Engineer*, April 19, '95. Continued May 24, '95.

Decorative Electric Lighting. A beautifully illustrated article showing the effect of electric light in various celebrated buildings; also various lamps, lampshades, chandeliers, etc. *London Elec. Review*, May 3, '95.

Effective Electric Lighting. By W. Perren Maycock, in *London Elec. Engineer.* A well illustrated article showing a number of ornamental lamps and chandeliers. *Elec. Review*, May 8, '95.

Borough of Cheltenham Electricity Works. The alternating system is used, with 2,000 volts in the station. Each alternator has corresponding to it a switchboard, placed opposite to it on the switchboard wall of the engine room, and there are also a return switchboard and a synchronizer board for the machines collectively. There are six sub-stations. *Lightning*, May 16, '95.

Arc Light Armatures for Streets and Public Squares. By F. Uppenborn. Writer speaks about the system in Munich, of which city he is city electrician and chief engineer. *Zeitschrift fuer Beleuchtungswesen*, and *Die Elektrizität*, May 25, '95.

Location of Electric Lighting Plants. By Prof. Francis C. Crocker, Ph. D. To determine the location of an electric lighting plant is often a matter of great difficulty, owing to the fact that so many considerations are involved, the prominent of which are the following:

1. Kind of power used (water or steam).
2. State and municipal laws and insurance rates.
3. Size, form and character of the district and distribution of lamps to be lighted.
4. Cost of ground space.
5. Room for extension.
6. Convenience of coal supply.
7. Convenience of water supply for boilers and condensers.
8. Possibility of obtaining good foundations.
9. Possibility of obtaining good chimney draught.

Writer treats those points in detail in ELECTRIC POWER, June, '95.

Electric Lighting of the Baltic Sea. By Carl Coerper. As it was necessary to light not only the line of the canal itself, but also to provide for the great demand for illumination of the locks, harbors, buildings and lighthouses, the following fundamental conditions were laid down:

1. Two operating plants to be built, one at Holtman, the other at Brunsbüttel.

2. Plants to have the most reliable and economical machinery and apparatus, and a complete reserve to be provided.

3. Potential automatically to be kept constant in the two operating plants, however much the load may vary.

4. Each light to be completely independent of the others, so that the extinguishing of a great number of lamps will have no influence on those left burning.

5. All minor accessory apparatus, such as main current regulators, oil insulators, etc., to be avoided.

The way in which these conditions were carried out is described in *Elec. World*, June 22, '95.

The Shunt vs. Differential Arc Lamp. By E. R. Knowles, C. E. Writer roughly sketches three types of lamps, one operated by a main circuit magnet only and only capable of running as a single lamp; one operating by a shunt magnet only and running singly or under proper circuit conditions capable of running in series with other lamps of the same type, and one acting by means of the differential action of a main and shunt magnet and capable of running singly or under all conditions of circuit in series with others of the same type. He designates these lamps as the main, the shunt and the differential lamp. *Elec. Engineer*, June 26, '95.

Arrangement of an Electric Lighting Plant. By Prof. Francis B. Crocker, Ph. D. Writer speaks about the various systems of arranging the machinery in the buildings and dwells upon the various methods of connecting dynamos to engines. ELECTRIC POWER, July, '95.

The Use of the Alternating Current for Lighting Gedney's Channel, New York Harbor. Description of plant and installation. *Elec. Engineer*, July 31, '95.

Scribner Double-Carbon Arc Lamp Held to be Non-infringing. An important patent decision handed down by Judge Showalter in the United States Circuit Court on July 24, 1895. *Western Electrician*, Aug. 3, '95.

Sir David Salomons on the Electric Lighting of a Great City. An illustrated interview. See London *Lightning*, Aug. 15, '95.

Earl's Court Exhibition at Night. An illustrated description of various electric light effects. *London Elec. Review*, Aug. 16, '95.

Notes on the Experimental Investigations of the Arc. By W. H. Freedman, E.E. A history of the procedure which finally resulted in separating by actual measurements the counter electromotive force from the resistance. ELECTRIC POWER, September, '95.

Photometry of Arc and Incandescent Lighting. By Prof. W. M. Stine. Photometric, or candle power measurements, are not too difficult to be made in the general operation of central stations. They require both care and patience, but simple apparatus will be sufficient. Their value in disputed cases alone will abundantly repay all the expenditure of time and effort. The elementary theory of such measurements will treat: (*a*) quality and quantity of light;

(*b*) standard of candle power ; (*c*) distribution of light in both the arc and incandescent lamps ; (*d*) principles of the measurement of candle power. The practice will deal with : (*a*) description of simple photometer ; (*b*) use of simple photometer ; (*c*) directions for constructing a simple photometer. These are taken up in detail in *Elec. Industries*, September, '95, and subsequent issues.

On the Cost of the Electric Light in Private Houses. By W. v. Winkler. Writer shows that the expense of the electric light is but very little higher than that of gas light, principally on account of the saving in actual hours of burning, on account of the convenience in turning the electric lights on and off. *Die Elektrizität*, Sept. 28, '95.

Photometry of Arc and Incandescent Lamps. By Prof. W. M. Stine. A paper on the distribution of light and the principles of the measurements of candle power. *Elec. Industries*, October, '95.

European Incandescent Lamps. By D. Paisley. Figures showing results of some trials of lamps run at the voltage marked on the lamps, which was in all cases 100 volts. The readings were taken every week, but the tables attached comprise the results at the beginning of the run, at 350 hours and at 600 hours, notes being given of the life of such lamps as burned out before the end of the 600 hours. *Electricity*, Oct. 2, '95.

Small Arc Lamps. Description of arc lamps which are to take but one to three amperes. Various methods of connections, also comparisons between various regulating mechanisms are brought out. *Elektrotechn. Anzeiger*, Oct. 3, '95.

Lighthouse, Buoy and Lightship Illumination. A splendidly illustrated article on the various types of buoys, including the electric buoys in New York harbor. *Scientific Am. Supplement*, Oct. 12, '95.

Superiority of Alternating Over Continuous Current for Incandescent Glow Lamps. By C. J. Robertson. From *London Elec. Review*. The writer bases his assertions on experiments which he performed. *Elec. Engineer*, Oct. 16, '95.

The Moore Etheric Lighting System. The fundamental principles employed in the Moore system of "etheric" lighting, consist in generating electric waves or vibrations suitable for producing luminous effects by interrupting the flow of electric currents through a circuit of induction in a high vacuum. For details and diagrams inspect *Elec. Engineer*, Oct. 23, '95.

Electricity at the Exposition of 1900. By Georges Dumont. Discussion on the importance of having the exposition well lighted. 1,200 horse-power is the estimate for lighting. *L'Electricien*, Oct. 26, '95, and subsequent issue.

Standardizing Incandescent Lamps. By R. E. Richardson. The writer points out the very unsatisfactory methods of testing candle-power at the present time. He calls attention to various methods of testing and urges that the engineering associations may take it upon themselves to furnish a standard flame. *Elec. World*, Oct. 26, '95.

The Electric Light in Theaters. By Julien Lefèvre. Writer treats some of the stage effects and explains several lamps, principally one used by Company Mayrhofer in connection with the Urania Theater. *L'Electricien*, Nov. 2, '95.

Street Lighting by Arc Lamps. By André Blondel. Translated by John Hesketh. A very complete essay on this subject. *London Electrician*, Nov. 8, '95.

Photographs of the Electric Arc. Prof. Violle, having shown that the brilliancy of the crater was the same for currents between 10 and 400 amperes, was anxious to make sure that it was the same with currents of 1,000 to 1,200 amperes. It was found to be rigorously constant. *London Electrician*, Nov. 8, '95.

The Arc Light. By Prof S. P. Thompson, D.Sc., F.R.S. Lecture I. of Cantor lectures, delivered before the Society of Arts. This lecture treats: Physics of the Arc; Early Discoveries; Arcs between Metal Electrodes; Arcs and Sparks; The Normal Arc and Relations between Voltage; Resistance and Length of Arc. To be continued in subsequent issues of *London Elec. Engineer*, Nov. 8, '95.

Study of the Alternate Arc. Results of an experimental investigation of the variations of light intensity. *Elec. Review*, Nov. 9, '95.

Reactance System of Arc Lighting. By Wm. Smith Horry. Illustrated description of system. *Elec. Engineer*, Nov. 13, '95.

Philadelphia and Reading Terminal and Station in Philadelphia. By Joseph M. Wilson, C. E. Paper read before the Amer. Soc. of Civil Engineers. A short description of the installation appeared in *Am. Gas Light Journal*, Nov. 25, '95; *Elec. Engineer*, Nov. 13, '95.

Chase Electric Cyclorama. By an ingenious combination of arc lamps, fed from rubbing contacts on a circular track suspended from the ceiling of an exhibition room, and an arrangement of especially devised projecting lenses and a continuous photographic film, with the necessary mechanism for blending and adjusting the projected sections of the picture in complete cycloramic view, Chas. A. Chase, a Chicago inventor, has devised the interesting apparatus described, with illustrations, in *Western Electrician*, Nov. 16, '95.

A Floating Pillar of Light at Atlanta. It rises more than 30 feet from the lake and rests on a circular platform, which is buoyed up by oil barrels. Around the stem of the tower run spirals of Edison miniature lamps of six C. P. These lamps are on different circuits which can be commutated automatically or by hand. The idea is due to Mr. Stieringer. *Elec. Engineer*, Nov. 20, '95.

West Side Park Lighting System in Chicago. Detailed consideration of boilers, fuel, furnaces or Stoker engine, jack shaft, clutches, etc., lamps, cables, poles, cost and cost of operation are treated in *Western Electrician*, Nov. 23, '95.

Incandescent Lighting by Gas and Electricity in Combination. By Louis Denayronze, Engineer, of Paris. From the Austria-Hungarian *Patent Gazette*. A small motor driven by electric cur-

rent revolves a burner which sucks in air, thus making a rich gas flame. *Elec. Engineer*, Nov. 27, '95.

The Two Hundred Volt Lamp Question. The desirability of a system of that sort is advocated in *London Elec. Review*, and copied in *Elec. Review*, Dec. 4, '95.

Arc Lamp. Description of a patent belonging to the firm Niewerth & Co. This lamp has the two carbons in an acute angle, to prevent the throwing of a shadow. *Elektrotechn. Anzeiger*, Dec. 8, '95.

The Luminosity of the Hydro Carbon Flames. By Dr. W. H. Birchmore. The article is divided into the following sub-heads: 1. The changes produced in hydro carbons by heat. 2. The physical changes involved in breaking a molecule. *Elec. Engineer*, Dec. 18, '95.

Notes on an Investigation of the Alternating Current Arc. By J. A. Fleming, D. Sc., F. R. S., and E. Petavel. Two series of researches; the first relating to the comparative spherical candle-powers of alternating and continuous arcs, when equal amounts of power are expended in them. It was found that the mean spherical candle-power between practical limits for the continuous arc was nearly twice that of the alternating arc. The second line of research deals with the space and time distributions of the luminous intensity in an alternating arc. *London Electrician*, Dec. 20, '95.

Selection of Steam Engines for Electric Lighting Plants. By Francis B. Crocker, Ph. D. Writer discusses: 1. Number of units; 2. Relative size of the units; 3. The type selected; 4. Direct coupling; 5. Belt connection. *Elec. Engineer*, Dec. 25, '95.

MAGNETISM.

Some Tests of the Magnetic Qualities of Gun Steel. By George O. Squier, Ph. D., Lieutenant U. S. A., from the *Journal of the U. S. Artillery.* In this article we find some very valuable results, as far as hysteresis, factors and permeability are concerned. The writer seems to have been successful in using the reversal method of testing. ELECTRIC POWER, Dec., '94.

A Method of Determining Induction and Hysteresis Curves. By Frank Holden. Description of apparatus. *Elec. World*, Dec. 15, '94; *London Elec. Review*, Jan. 4, '95.

Magnetic Properties of Liquid Oxygen. A review of the work of Prof. Dewar in this direction. *Am. Gas Light Journal*, Dec. 31, '94.

Effects of Magnetization upon Dimensions of Iron Rings. By Shelford Bridwell, M. A., F. R. S. This paper is taken from the *Proceedings* of the Royal Society. It treats especially the effect in directions perpendicular to the magnetization upon the volumes of rings. The results of the experiments are summarized in tables, and the experiment of others in that line of work are referred to. *London Elec. Engineer*, Jan. 4, '95.

A Magnetometer for Showing the Influence of Temperature on the Magnetization of Iron and other Magnetic Substances. By Henry Wilde, F. R. S. After a review of the experiments made by the writer, and after giving a brief summary of the work done by others in this direction, the magneto-meter used in Mr. Wilde's experiments is illustrated and the action of the instrument is described as follows:—The needle is drawn out of the magnetic meridian from 15° to 20° by turning the disc on its axis. The magnetic substance is then brought round towards the needle until equilibrium is established between its magnetism and the horizontal component of the earth's magnetism. The magnetic substance is heated by a small gas flame from below; when the needle recedes from heated iron, magnetite, and nickel, and advances again when the source of heat is removed; thereby indicating a decrease of magnetic power for these substances. On the other hand, the needle advances towards cobalt when heated, and recedes when the metal is cooled, by reason of its enormous surface resistance, which only disappears, as I have said, under the action of powerful magnetizing forces. *London Elec. Review*, Jan. 18, '95.

The Best Metal for Field Magnet Frames. By Alton D. Adams. A paper read before the American Institute of Electrical Engineers, Jan. 16, '95. A discussion on the problem of cast iron, vs. cast steel and wrought iron. The following gentlemen took part in the discussion: Prof. F. B. Crocker, Mr. Fleming, Dr. Sheldon, Messrs. Kennelly, Dunn, Burke, Bliss. *Trans. Am. Inst. Elec. Eng.*, Jan.,

'95 ; *Elec. Review*, Jan. 23, '95 ; *Elec. Age*, Jan. 26, '95 ; *Elec. World*, Jan. 26, '95 ; *Elec. Engineer*, Jan. 30, '95.

Principles of Dynamo Design. By Newton Harrison, E. E. A series of articles in which the writer discusses magnetic leakage and the influence of impurities on the permeability of iron and steel. *Elec. Age*, Jan. 19 and Feb. 2, '95.

Magnetic Mechanism. By Wilbur M. Stine. The writer attempts to connect such known relations as fields of force, charges, etc., by means of mechanical conceptions, admitting that it may be open to more or less criticism, although it cannot be wholly devoid of value. Descriptive illustrations given in *Elec. Age*, Feb. 9, '95.

Steel and Iron for Field Magnets. By Lewis T. Robinson. A number of examination of wrought iron samples have led to the conclusion that the general run of commercial wrought iron of American make is about as represented in the following table:

B	*H*	μ
4,000	3 03	1,320
6,000	4.05	1,480
8,000	6.2	1,290
10,000	9.71	1,030
12,000	16.9	710
14,000	33.3	420
16,000	133.5	120

Elec. World, April 6, '95.

Effects of Electric Currents in Iron and its Magnetism. By Dr. J. Hopkinson, F.R.S. Paper read before the Royal Institution.

Iron, as everybody knows, is a good conductor of electricity, not so good as copper, but still much better than any other substance than the metals. In a magnet, then, with a solid iron core, the outer portions of the iron are in a similar position to the copper coils surrounding the iron. On reversing the magnetizing current, currents will be induced in the iron, and these currents will delay the changes of magnetic induction within them, and they will delay them the more the deeper in the iron is the point under consideration. * * *

In conclusion, let us indulge in a little wild speculation, not because it is probable that it is in any sense true, but because it is interesting. Suppose a magnet were made exactly like the one on which we experimented, but of the size of the earth, and that some mighty electrician generated such a current in its copper coils as would give a magnetizing force of 2.5, and then reversed it, it would take some thousands of millions of years before the rate of disturbance at the centre attained its maximum value. The speculation I suggest is this : Is it not conceivable that the magnetism of the earth may be due to currents in its material sustained by its changing induction but slowly dying away. *London Elec. Engineer*, May 3, '95.

Curves for Winding Magnets. By Harrison H. Wood. The principal part of the paper are two sets of curves, showing the relation between current and total length of wire. *Electrical World*, May 4, '95.

On a Possible Law of Residual Magnetism in Iron and Steel. By Houston and Kennelly. So far as the authors are aware, no relation has been published between the magnetic intensity attained in a bar of iron or steel and the residual intensity upon the removal of the magnetizing force. They have discovered from a comparison of these values in the measurements made by Prof. Ewing which they have been able to examine, that a relation of a linear character seems to exist between these quantities, that is to say, any increase or decrease in the magnetic intensity produced in iron or steel appears to be followed by a corresponding increase or decrease of residual intensity in a fixed ratio. *Elec. World*, June 1, '95.

Some Work on Magnetic Hysteresis. By Frank Holden. Writer describes a simple hysteresis meter which has been in successful commercial use for several years and has given results sufficiently accurate for practical purposes. *Elec. World*, June 15, '95.

Experiments on the Relation of Hysteresis to Temperature. By Frank A. Laws and Henry E. Warren. This paper gives an account of some experiments to determine the effects of temperatures much above the normal on the dissipation of energy by hysteresis in a specimen of steel. Detailed description of method and some results are given in *Electricity*, June 26, '95.

Magnetic Separation of Iron-Ores. By Clinton M. Ball. After the writer has carefully explained the requirements of an ore-separator, he goes into a general description of this apparatus and cites examples of accomplished work. *Engineering Magazine*, August, '95.

Unipolar Induction. By D. C. L. Weber. Various experiments are described and carefully discussed. *Electrotechn. Zeitschrift*, Aug. 15, '95 ; *Electricity*, Sept. 11, '95.

On an Approximate Law of Magnetic Remanence in Iron and Steel. By E. J. Houston and A. E. Kennelly. Writers advance further proofs of the law recently announced by them concerning the relation between magnetic remanence of soft iron and steel and the maximum cyclic intensity of induction. *Elec. World*, Aug. 24, '95.

The Propagation of the Magnetization of Iron. By W. Peukert. Abstracted from *Elektrotechn. Zeitschrift*, Sept. 19, '95.

When a long, straight iron bar is excited by a magnetizing coil situated at the centre, the lines of force, all of which pass through the coil, do not keep in the iron up to its extreme end, but emerge into the air at all points along its length, so that the induction in the bar falls off continuously as the distance from the central source of magnetization is increased. With a periodically varying magnetizing force the same effect is produced, and, moreover, the corresponding periodic changes in the induction induce eddy currents in the iron. These cause a lag in the phase of the induction which increases as the end of the bar is approached.

Experimental proof of this was carried out on rods of about one metre length of wrought and cast-iron, and on a large bundle of

soft iron wires of 1mm. diameter. The induction at various points was measured by search coils placed at intervals on the bar, and readings of the instantaneous values of the induction were taken through a complete period for each coil. Magnetomotive forces of 288 and 1,306 ampere-turns were used. The curves of induced E. M. F. obtained from all three samples show a shift of phase which increases with the distance of the search coil from the centre of the bar, both at the lower and at the higher values of the induction. There is no marked difference between the changes of phase produced in the solid and in the laminated specimens, the amount of shift not being sufficiently clearly defined to show any distinct difference. The magnitude of the deflections continuously falls off along the bar, showing the diminution in the induction. *London Electrician*, Oct. 11, '95.

Lengthening of Magnetized Bars. The *Philosophical Magazine* contains a paper by Dr. L. T. More, investigating the true causes of the change of length in soft iron bars produced by magnetization. It appears that there is a contractive force which opposes (unsuccessfully) the lengthening due to the new orientation of the molecules. The net effect is a gradual elongation, which becomes more and more rapid, and reaches a maximum at a field intensity of 1,200 and then suddenly falls. Hardening the wire diminishes the elongation, and the maximum sets in sooner. Stretching has the same effect; but allowance must be made for a change in elasticity produced by magnetization. *London Electrician*, Oct. 18, '95.

Magnetic Field of a Rectangular Coil. By Prof G. M. Minchin, M.A., F.R.S. In this paper writer shows how to calculate practically the component of magnetic force parallel to the axis of a coil of any dimensions at any point in space, and also the value of the potential due to any flat rectangular coils. A few numerical examples are added by way of illustration. *London Electrician*, Nov. 8, '95.

The Magnetic Field of any Cylindrical Coil or Plane Circuit. By Mr. W. H. Everett. The method of treatment is based on the formula for the force due to an element of current. A single integration applied to one component of this force gives for any point in the field due to a plane circuit the force perpendicular to its plane, and a double integration gives the longitudinal force at any point due to a cylindrical coil of any cross-section, the depth of winding being supposed inconsiderable. For coils in which the latter condition does not hold, an approximate solution can readily be found. The force parallel to the plane of a circuit and the transverse force due to a coil are investigated in a similar manner. Special formulæ are deduced for coils of rectangular cross-section. Appended to the paper are some numerical results giving the values of the forces at different points due to coils of various dimensions. *London Elec. Engineer*, Nov. 15, '95.

Magnetic Clocks. Description taken out of a very rare book called "Traité D'Aiman," published in 1687 by Dalencé. Copied from *La Nature* in *Scientific American Suppl.*, Nov. 16, '95.

On an Approximate Linear Relation Between Coercive Force and Maximum Cyclic Intensity in Iron and Steel. By Houston and Kennelly. *Elec. World*, Nov. 16, '95.

The Magnetic Separation of Iron Ore. At a recent meeting of the American Institution of Mining Engineers, a paper was read by Clinton M. Ball, which, after some consideration of the general conditions for magnetic separation, described the Ball-Norton electromagnetic separator and a number of the plants built and experiments made in this class of work, especially those at the Benson mines in St. Lawrence County, N. Y., at the Jayville mine in the same district, and at Mineville in Essex County, N. Y. At a moderate estimate, the ore crushing capacity of existing plants located in the Adirondack region of New York and in New Jersey and Pennsylvania, is sufficient to make more than 1,000,000 tons of high-grade concentrates per annum. *London Engineering Review*, Nov. 20, '95.

Explanation for the Repulsion of the Thomson Ring, by the Reaction of Magnetic Lines of Force, Produced by Selfinduction. By By Wladimir de Nikolaieve. Author speaks of the phenomenon of magnetic selfinduction. *L'Eclairage Electrique*, Nov. 23, '95.

MEASUREMENTS AND MEASURING INSTRUMENTS.

The Galvanometer in the Station. The value of the d'Arsonval galvanometer for station work is referred to, and it is pointed out that this instrument is not so difficult to manage as it is usually supposed to be. *Industries and Iron. Elec. Engineering*, Dec., '94.

Methods of Determining the Efficiency of Dynamos and Motors. By J. Reginald Ashworth. The writer divides the subject into: 1. Gross Efficiency, or Efficiency of Conversion; 2. Net Efficiency, or Commercial; 3. Electric (or Economic) Efficiency. For each one of these particular formulæ are derived. *Elec. Plant and Elec. Industry*, Dec., '94.

Central Station Instrument Equipment. By Frank H. Walder. A description of the most important station instruments, with diagrams and methods of making tests. *Lightning*, Dec. 20, '94.

A Practical Method for Measuring Rapid Changes in Currents. By Walter E. Harrington. The writer, after trying different methods, finally adopted the following: A magnetic circuit breaker was employed, which could be sensitively adjusted to open on different currents within its range, and which could have its time element of opening the circuit inversely proportional to the current causing the opening. The instrument was so very rapid in opening the circuit, that arcing was entirely obviated. *Elec. World*, Dec. 22, '94.

Physical Units. By Magnus Maclean, M. A., F. R. S. E. The continuation of an article on this subject. The present one deals with Quantity, Current, Resistance, Electromotive Force and Capacity, all measured by electromagnetic as well as electrostatic effects. *London Elec. Engineer*, Dec. 28, '94.

Shallenberger's New Alternating Current Meters and Indicators. A description with a number of illustrations, such as multiphase integrating meters, single phase integrating meters; diagrams of these various meters and indicating Watt meters. *Elec. Engineer*, Jan. 2, '95.

On the Electrical Resistances of Certain Poor Conductors. By B. O. Pierce. From the proceedings of the American Academy, Oct. 10, '94. The paper gives a number of carefully prepared tables for poor conductors. *London Elec. Review*, Jan. 11, '95.

The Testing and Inspection of Electric Light Cables. The paper first considers high resistance in megohms, vs. discharges, pointing out the superior value of the latter and then gives some points on the measurement of cables. *London Elec. Review*, Jan. 11, '95.

Method of Measuring Atmospheric Resistance. Copied from the *Western Electrician.* Description of an instrument by means of which to make very accurate tests. *London Elec. Review*, Jan. 11, '95.

Apparatus for Determining the Mechanical Equivalent of Heat. Prepared by Prof. W. E. Aryton and Mr. H. C. Haycraft. The measurements to be made are: (*a*) The value of the constant current passed through the resistance, as given by direct reading ammeters; (*b*) the average value of P. D. between the terminals of the resistance, as given by a direct reading voltmeter; (*c*) the mass of water heated, plus the water equivalent to the containing vessel, resistance coil, and stirrer; (*d*) rise of temperature of water; (*e*) time during which current is passed. *London Pract. Engineer*, Jan. 11, '95.

A Few Words on "Carrying Capacity" of Conductors. By J. E. Talbot. The principal point of the paper is the statement that "carrying capacity" means or implies a current density of 1000 amperes per square inch, involving an increase of about 20 degrees Fahrenheit. *Elec. Review*, Jan. 30, '95.

Lightning Arresters for High Tension Current. By Dr. A. Denzler, Zürich. The writer first considers line protection, and divides this into three sections; 1. Prevention of atmospheric discharges into apparatus and machinery; 2. Leading off the charges into the ground; 3. Prevention of short-circuits through the earth or at least to interrupt them before they can do serious harm. To be continued in subsequent issues. *Die Elektrizität*, Feb., '95.

The Construction and Use of Electrical Measuring Instruments. By C. H. Yeaman. The second of a series of articles is only introductory. *London Electricity*, Feb. 1, '95.

The Construction and Use of Electrical Measuring Instruments. By C. H. Yeaman. The first of a series of articles in which the author describes a method of making an instrument to measure the current in amperes by means of a weight, a balance. After mention has been made of the other units, he will give the comparative values of the ampere and its definition, in subsequent issues. *London Electricity*, Feb. 8, '95.

How to Build a Rheostat. For Amateurs. By G. E. Dunton. A description, with illustrations. *Elec. World*, Feb. 9, '95.

On the Electrical Resistance of Certain Poor Conductors. By B. O. Pierce. The principal feature of the paper is a comparative table showing the resistances of various kinds of wood. *Practical Engineer*, Feb. 15, '95.

On the Construction and Use of Electrical Measuring Instruments. By Chas. H. Yeaman. Explains the time constant and reactance. *London Electricity*, Feb. 22, '95.

Practical Testing. By W. H. Freedman and Max Osterberg. The first of a series of articles which deal with the laboratory and shop practice of electrical testing. The first article, which is only introductory, explains the designing of a dynamo. ELECTRIC POWER, March, '95.

Lightning Arresters for High Tension Currents. By Dr. A. Denzler. The third of a series of articles treats "Appliances for

Preventing Short-Circuits of Dynamos Through the Earth." Explains principally the Thomson-Houston, the Westinghouse (Wurts) and the Vail systems. *Die Elektrizität*, March 2, '95.

On the Delineation of Alternating Current Curves when the Alternator is not Accessible. By Dr. J. A. Fleming, F. R. S. Abstract from *London Electrician*. For description of apparatus see *Elec. Engineer*, March 6, '95.

Modification of the Ballistic Galvanometer System to Determine the Electro-Magnetic Capacity of a Condenser. By F. Womack. Taken from the *Philosophical Magazine*, Feb., '95. This method can serve for the simultaneous determination of resistance capacity and induction of a submarine cable, a telephone or a telegraph line. *L'Eclairage Electrique*, March 9, 95.

A New Method for Measuring Illumination. By Prof. E. J. Houston and A. E. Kennelly, F. R. S. Paper read before the National Electric Light Association, Feb. 19–21. at Cleveland, O. The question at issue is not so much the photometric intensity of the sources of light and their distribution, as it is the degree of illumination actually produced, and this requires the use of an illuminometer. Detailed description of apparatus is given in *Elec. Engineer*, March 6, '95 ; *Elec. World*, March 9, '95 ; *Elec. Review*, March 13, '95.

A Method of Determining the Eddy Current and Hysteresis Losses in Direct Current Armatures. By A. W. K. Pierce. *Electricity*, March 13, '95.

Electrical Units. The Act of Congress, passed July 12, '94, which established and defined certain units of electrical measure, required that the National Academy of Sciences should prescribe and publish specifications for the practical applications of these units. These specifications refer to the ampere and volt, and appeared in *Elec. World*, March 23, '95.

Electrical Condition of Buried Conductors Due to Leakage Currents from Electric Railways. By W. Stuart-Smith. A carefully prepared paper which is the outcome of a long series of tests made by the author for the San Francisco Gas Company. Commenced, and to be continued in subsequent issues of *Elec. World*, March 23, '95.

Stages and Types of the Tesla Oscillator. The development of the various types of the oscillator, commencing with those exhibited at Chicago, up to the most modern ones, unfortunately destroyed by fire. *Elec. Engineer*, April 3, '95.

Theory of the Tangent Galvanometer. By Jas. Bell and S. Wilson. *London Electricity*, April 5, '95.

Lieutenant Fiske's Range Finder. This instrument has been adopted by the United States Navy. The instrument is based on the measurement of resistance of a conductor in the form of a Wheatstone bridge, there being two arcs of wire at the ends of a base line, each arc corresponding to two contiguous members of

the bridge. Two telescopes are located at the ends of the base line and carry contacts which move over the wire as the telescopes are turned in the angle to be pointed upon the subject. For detailed description with illustrations see *Elec. Engineer*, April 10, '95.

Combination Electrical Meter. Illustrated description of an instrument patented by Mr. Herschel C. Parker by means of which amperes, volts, ohms and watts can be read at the same time. ELECTRIC POWER, April '95 ; *Scientific American*, April 13, '95.

New Aperiodic Volt- and Ammeters. By R. Arnoux. Description of two new instruments for very delicate measurements. *Bull. de la Société Internat. des Electriciens*, April, '95.

Construction and Use of Electrical Measuring Instruments. By Charles H. Yeaman. Continuation of article previously referred to, deals with slide rules and planimeters. *Electricity*, (*London*) April 11, '95.

Variation of Internal Resistance of a Voltaic Cell with Current. By Henry S. Carhart. Internal resistance of a voltaic cell, when at constant temperature, has not a fixed and finite value, but is a function of the current flowing through it. The change of resistance with the current is exhibited in a marked degree by dry cells. The writer gives various tables and explains methods of experimenting in *Physical Review*, March, '95; reprinted in *Western Electrician*, April 13, '95.

Apparatus for Measuring Difference of Phase Between Alternating Currents. By Louis Derr, M. A., S. B. A method which is claimed by the writer to be applicable to the measurements of periodic currents of any form whatever, and which can be used under ordinary conditions. *Technology Quarterly* and *Western Electrician*, April 13, '95.

Investigation on Induction in Cables. By Dr. F. Breisig. Discussion of the theory of the flow of alternating currents in two inductive circuits. *Elektrotechn. Zeitschrift*, April 18, '95.

Quadrant Electrometer as Differential Instrument. By Hermann Eisler. Every quadrant electrometer can be arranged like a differential instrument and then be used to test resistances by a zero method. This is especially valuable as alternating currents can be measured for inductive resistance by a zero method of that sort. Described in *Elektrotechn. Zeitschrift*, April 25, '95.

An Extremely Sensitive Galvanometer. By Pierre Weiss. An especially devised sensitive instrument for the measurement of very low magnetization. *L'Electricien*, April 27, '95.

Non-Magnetic Electric Devices. By W. E. Irish. Writer discusses electro-thermal fuses, platinum wire lamps, regulators for steam, hot water, gas and electricity, electrical regulator, thermostats, galvanometers, mechanical telephones, thermal recording telephones, lightning arresters, bells, sounders, syphon recorder, ampere and other indicators, motor regulation, automatic resistances, direct series arc lamp automatic cut-out and variable shunt, low potential

arc lamp regulator, pole and other cut-outs, arc lamps, non-magnetic electric motors. *Elec. Engineer*, May 8, '95.

A New Form of Carey-Foster Commutator. By W. M. Stine. A device for the comparison of standards of resistance and employed for the measurement of conductivity and temperature coefficients of metals, and measurements in general of low resistance; devised by the writer. Description of same appeared in *Elec. Engineer*, May 8, '95.

Disturbances of Magnetic and Electric Measuring Instruments by Electric Railways and their Prevention. By A. Voller. It is in the first place pretty definitely established, says the author, that the principal disturbances are due not to inductive action from the overhead wire but from the idle earth currents which leave the rails. Careful experiments were made before the site for the electrical laboratory in Hamburg was selected. *Elektrotechn. Zeitschrift*, May 9, '95.

Galvanometer Construction at Lehigh University. By Edwin E. Fisher. During the Fall of '94, a piece of work well worthy of note was undertaken by the junior students of the electrical engineering department of Lehigh University. The work consisted in the construction of a set of galvanometers for use in the laboratory. The complete description of the instruments is given in *Elec. World*, May 11, '95.

The Ballistic Galvanometer and its Use in Magnetic Measurements. By Thomas Gray. The object of the note is to direct more particular attention to the conditions under which accurate results may be obtained. *Science*, May 17, '95.

The Zero-Torque Electricity Meter. By Joseph Edmondson. The zero-torque electricity meter, as its name implies, consists of a zero-reading dynamometer, combined with mechanism for measuring and integrating, at short intervals, the torque exerted on the moving coil by the current going into consumption.

The Siemens dynamometer is familiar to electricians as an instrument of the utmost simplicity and accuracy, giving, when coupled as a wattmeter, absolutely proportional readings throughout any range. Its obvious advantages in these respects point to it as a pre-eminently suitable basis for a supply meter. Heretofore, however, the action of all such instruments has depended on complicated arrangements for making and breaking contact. In a zero-torque meter these are entirely avoided. The moving coil of the dynamometer is in a closed circuit which is never broken. It carries a small steel stop which controls the registering without in the slightest degree interfering with the free and frictionless action of the instrument.

The motion of the moving coil being limited to an arc of less than one degree, permits the use of a durable steel wire suspension instead of the delicate suspension of the ordinary dynamometer. A torque of about 90 degrees is given to the usual spiral spring every two minutes by a reciprocating quadrant, or "mangle wheel," driven by a vibrating motor consisting of a magnet and its armature. This

motor is controlled by a small gravity driven pendulum, starting automatically and having a sparkless contact. *London Elec. Engineer*, May 17, '95.

The Evolution of a Connected System of Units. By Townsend Wolcott. The object of this article is to call attention to some salient facts, and the fundamental principles underlying them, which throw light upon the general development of units, from their crude beginning to the present time, and which ought to guide us somewhat in future work. ELECTRIC POWER, May, '95.

Present Range and Accuracy in the Measurement of Electrical Resistance. By Herschel C. Parker. Writer points out the various methods by means of which very accurate measuring may be accomplished. ELECTRIC POWER, May, '95.

A New Automatic Regulator for the Brush Arc Dynamo. By Horatio A. Foster. Description of instrument with a number of diagrams appeared in ELECTRIC POWER, May, '95.

On the True Dimensions of the Electrostatic and Electromagnetic Units, and on the Right Use of the Terms Intensity, Strength, Force and ℭ. By Reginald A. Fessenden. A number of imperfections in our present system of dimensions and names for electrical units are pointed out. Writer also refers to the usefulness of the terminations *-age*, *-ance* and *-ivity*. *Elec. World*, May 4, '95.

Electrical Thermal Devices. By W. M. Stine. Though the hot wire is in general an inferior device when compared with an electromagnet, there are cases in which it can be used to advantage. Writer then discusses galvanometers, ammeters, voltmeters, indicators and thermal arc lamps. *Elec. Engineer*, May 29, '95.

Experimental Determination of Objectionable Magnetism in a Continuous Current Armature. By Ludwig Baumgardt. Writer describes a method for measuring the objectionable lines of force, and finds by actual experiment that outside of a few minor corrections the useful lines are about 6.5 times as many as the objectionable ones. *Elektrotechn. Zeitschrift*, June 6, '95.

Measurement of Very High Voltage. By Abraham and Lemoine. Description of two electrometers. *L'Eclairage Electrique*, June 8, '95.

Self-Induction and Capacity. By E. B. Rosa. In order to show the relation between these two quantities, the writer discusses: 1. Mechanical analogies; 2. The electrical case; 3. Coil and condenser on alternating circuit; 4. Kinetic and potential energy; 5. Numerical example; 6. Relation of capacity to self-induction and period; 7. Condenser in parallel with coil; 8. Condenser and coil independent; 9. Constant current circuit. *Elec. World*, June 8, '95.

Massachusetts Commission on Electric Meters. The Massachusetts Board of Gas and Electric Light Commissioners submitted a report to the State Senate on a matter of electric light meters. The report is contained in full in *Am. Gas Light Journal*, June 10, '95.

Absolute Measurement of Electrical Resistance. By Prof. J. V. Jones, M. A., F. R. S. Description of a number of methods and also a rather philosophical discussion on absolute resistance. *London Elec. Engineer*, June 14, '95.

On the Theory of Units. By Townsend Wolcott. The writer attacks in a lively manner the Rückerian philosophy of units, which he considers to be founded upon a wrong conception as the nature of dimensional formulæ. *Elec. World*, June 15, '95.

Dimensional Formulæ and the Theory of Units. By R. A. Fessenden. This article is written in answer to an attack made by Mr. Wolcott in *Elec. World* of June 15, '95.

Prof. Fessenden says: My views on the subject, however, are: That the dimensional formula of a quantity is a full and sufficient definition of the nature of that quantity, so far as it is possible for human knowledge to go, and that, consequently, there is one and only one correct dimensional formula for any given quantity, and that if by any method we arrive at two different formulæ, one of them is incorrect.

Consequently, I regard dimensional formulæ as a legitimate form of mathematical analysis.

Elec. World, June 29, '95.

An Apparatus for Exact Measurement of E. M. F., Current and Resistance. By Wilh. Thiermann. Illustrated description of the apparatus, with detailed explanation of the method. *Elektrotechn. Zeitschrift*, June 27, '95.

Blondel Lumen Meter. This is an apparatus for the direct determination of the mean spherical intensity of a source of light. M. A. Blondel has designed this new method of measuring more quickly and accurately than by any previous attempt, mean spherical candle-powers, with a view to overcoming the old laborious methods which were complicated and uncertain.

Illustrated description is given in *London Elec. Engineer*, June 28, '95.

Variable Potential Rheostat. By W. M. Stine. Description of a new instrument designed by the writer. ELECTRIC POWER, July, '95.

A Galvanometer for Photographing Alternating Currents Curves. By H. J. Hotchkiss and F. E. Milbis. A modified form of Blondel's oscillograph is essentially a galvanometer having a very small needle of soft iron, a very strong field for the directing force, and a single small coil carrying the alternating current which deflects the needle. *Physical Review*, July, '95.

Residual Charge of Condensers. By A. S. Dunstan. This paper is for the purpose of describing some experiments undertaken for the purpose of studying the residual charges in condensers with mica dielectric. It was sought to connect the amount and rate of development of the residual charge, with different initial circumstances, such as varied potential of charging battery, varied time of charging, and the effect of a previous charge in the condenser. The

general idea was to obtain curves showing the residual charge at different instants under known initial conditions, and from a study of these curves deduce any laws that might become evident. As the method of obtaining these curves is somewhat different from any heretofore used, it is described in detail. *Elec. World* July 6, '95.

Sensibility of Galvanometers. By Prof. W. M. Stine. Author calls attention to the uncertainty and confusion existing in the rating of various types of galvanometers, and lays down certain principles which should govern the determination of a rational rating. *Elec. World*, July 13, '95.

New Method of Measuring Electric Capacities Based on the Sensitiveness of the Skin. By H. Bordier. The principle of the method is based upon an experiment by Prof. d'Arsonval. If condensers of increasing capacity are placed successively in series on the same induction coil, and if we seek, either by the aid of a rheostat or by moving the coil by predetermined steps, the moment in which the least sensation produced by the current on the skin is perceived, it is found that this moment varies for each added capacity. Results of experiments are contained in *London Elec. Engineer*, July 26, '95.

Relations Between Pressure, Electrical Resistance and Friction in Brush Contact. By E. V. Cox and H. W. Buck. Electrical engineering thesis, Columbia College. The authors have devised a method by means of which they arrived at the following conclusions:

1. The resistance of the brush contact does not vary inversely as the pressure, for beyond a certain point a great increase in pressure produces only a slight diminution in resistance. 2. The critical point in the various resistance curves occurs at different pressures for different brushes. 3. The contact resistance of carbon is much higher than that of copper. 4. The contact resistance of all brushes is less on a cast iron pulley than on a copper commutator. 5. Slightly oiling the cylindrical surface only slightly increases the contact resistance. 6. The tangential pull due to friction is directly proportional to the pressure on the brush. 7. Slightly oiling the cylindrical surface greatly diminished the friction. 8. For the same brush the friction is less on cast iron pulley than on a copper commutator. 9. The friction of a copper brush is greater than that of a carbon brush at the same pressure. 10. The friction of a radial carbon brush is greater than that of a tangential carbon brush at the same pressure. 11. The friction of all brushes is slightly less at high than at low peripheral speeds.

The most advantageous pressure at which to work any given brush will depend largely upon the relations existing at the different pressures between the loss of electrical energy due to ohmic resistance and the mechanical work consumed by the friction of the brush. The former can be found in watts for any point on one of the resistance curves by multiplying the resistance given for that point by the square of the current passing through the brush; and the latter, in horse-power, by multiplying the tangential pull in pounds,

due to the friction of the brush, by the peripheral speed in feet per minute and dividing this product by 33,000. For detailed description of method see *Elec. Engineer*, Aug. 7, '95.

Potentiometer and Its Uses. By Ellis H. Crapper. The first of a series of articles gives after a short introduction explaining the potentiometer and its uses, the construction of the instrument and comparison or determination of E. M. F. or D. P. *London Elec. Engineer*, Aug. 9, '95.

The Self-Induction of Armoured Mains. By J. Whitcher. Auther deals with some of the principal questions involved when the separate conductors of an alternate-current system are armoured with iron. He directs attention especially to the self-induction, and the consequent drop in the conductor and hysteresis loss in the iron. The extensive use of concentric and triple concentric conductors puts a large proportion of alternating-current conductors beyond the range of Mr. Whitcher's remarks; yet, as he says, there are a great many places where single mains are run in iron piping, where a knowledge of the inductive drop due to the iron would be valuable. The tables and formulæ which accompany this article in some measure supply this information; though, from the fact that these are deduced from theoretical considerations based upon sine wave currents, their application to any particular case must be made with necessary modifications. Mr. Whitcher finds that under practical conditions the loss due to hysteresis is not of great moment and is comparable with the Foucault current loss in the iron. *London Electian*, Aug. 30, '95.

Abdank's Hysteresis Compensator. The researches of Ewing, Hopkinson, and others have shown how greatly the action of iron depends upon its previous magnetic history, and hence when iron masses are employed in electrical indicating and other apparatus these effects of residual magnetism, coming under the more general class of hysteresis phenomena, introduce errors. As a result, indicating instruments of this type have been shunned in the past where accuracy was considered desirable. The simplicity and cheapness of this type of instruments have nevertheless given them considerable vogue, and the most recent attempt to remove the cause of objection to their use will therefore be of interest.

M. B. Abdank-Abakanowicz, of Paris, has just devised what he calls a hysteresis compensator, to effect the desired purpose. This he accomplishes by combining with a magnetic circuit one or more masses of iron or steel, constituting what he calls a "secondary differential magnetic circuit," the action of the lines of force of the secondary circuit being opposed to those of the principal circuit. By properly choosing the dimensions of the secondary, with reference to those of the principal magnetic circuit, a differential value may be obtained for all currents within the range of the apparatus which will be proportional to those currents. In other words, the effect of the residual magnetism of the first circuit is neutralized by the residual magnetism of the second.

For diagrams showing the application of the instrument, compare *Elec. Engineer*, Sept. 11, '95; *London Elec. Engineer*, Oct. 18, '95.

A Portable Magnetic Field Tester. By Prof. W. E. Ayrton, F.R.S. and T. Mather. Paper read at the meeting of the British Assoc. Description of a new instrument, with the theory of the same. *London Elec. Engineer*, Sept. 20, '95.

An Improved Portable Photometer. By W. H. Preece, F.R.S., and A. B. Trotter, B.A. Read before the British Assoc. Fully described and illustrated in *Elec. Review*, Oct. 9, '95; *Elec. World*, Oct. 5, '95; *Electricity*, Sept. 25, '95.

On Some New Methods for the Delineation of Alternate Current Wave forms. By James Mark Barr, W. Beckit Burnie, and C. Rodgers, B.S.,C.E. Paper read before the British Association, Sept. 18, '95.

Complete description of an apparatus which automatically records with great rapidity the wave form. Authors employ a combination of two motions at right angles of a spot of light relatively to a screen. An ordinary contact disk is used, *but the contact brush is moved slowly and continuously through its successive angular positions.* Contact is thus made each time at a slightly different position of the armature. Thus the potential difference at each contact differs slightly from that at the preceding contact. This potential difference is used to charge a condenser, across the terminals of which is connected either a reflecting electrometer or a high resistance galvanometer.

The deflection of the instrument so used follows the value of the potential difference of the wave form to be determined, and accurately follows it, for the mean rate of variation of the P.D. between the terminals of the condenser is exceedingly small in comparison with the rate of change of the electromotive force to be investigated. This deflection gives one of the component motions. The other motion of the light spot is made to be proportional to the angular movement of the contact brush. *London Elec. Review*, Sept. 27, '95; *Elec. World*, Oct. 12, '95.

Electrical Recording Instruments of the Weather Bureau. By Elisha C. Vose. The following instruments are illustrated and described: (1) Electrical sunshine recorder; (2) Anemoscope; (3) Metrograph; (4) Rain and snow gauge; (5) Register. *Elec. World*, Sept. 28, '95.

Variation in the Electrical Resistance of Bismuth When Cooled to the Temperature of Solid Air. By James Dewar, F.R.S. and J. A. Fleming, F.R.S. From the *Philosophical Magazine* and *London Elec. Review*, Oct. 4, '95.

Note on Some Manganin Resistance Coils. By E. O. Walker. A number of experiments which seem to point out that the Manganin coils tested have most valuable properties. *London Electrician*, Oct. 11, '95.

Collinson Ampere Hour Meter. A new instrument which works on the principle of measuring the electric quantity in terms of the weight or volume of a liquid permitted to pass through a throttled passage, the amount of constriction depending upon the electric

current. Illustrated and minutely described in *Electrical Review*, Oct. 23, '95.

Units of Force and Mass. By G. A. Goodenough. Discussion on the fundamental system of units. *American Machinist.* Oct. 24, '95.

A Simple Method of Measuring the Insulation Resistance of Storage Batteries. By E. S. Jacob. All the apparatus used in this method is such as forms part of a set of ordinary testing instruments, and the results are true under every condition. The same method might be used for measuring the insulation of a complicated network, *e.g.*, a five wire distribution, while current is passing. *London Elec. Engineer*, Oct. 25, '95.

Charging of a Condenser. By Alfred Hay, B. Sc. Experiments described are intended as a small contribution towards the already overwhelming mass of experimental evidence as to the existence of the oscillations which take place in the charge or discharge of a condenser when certain conditions as to capacity, resistance and induction are fulfilled. The main interest of the experiments described lies not so much in the fact of their showing, qualitatively, the existence of oscillation in the charge, as that they enable us to make a fairly accurate quantitative comparison between the actual curves of current and potential difference, and those deduced theoretically. *London Electrician*, Oct. 25, '95.

An Alternating Current Wattmeter. By Prof. John Perry, F.R.S. Prof. Perry describes a wattmeter in which any error due to lag is completely avoided in a simple manner. The use of such an instrument may prove advisable in some cases, although, as Prof. Perry points out, an ordinary dynamometer-wattmeter is quite accurate enough for most purposes, if a large non-inductive resistance is placed in series with the pressure coil. There are, however, two advantages about the new form of instrument. In the first place, its accuracy depends on the adjustment of the two oppositely wound coils, each of which carries a heavy current; and it would appear that a slight shift of one of the wires leading up to the coil would be enough to introduce a perceptible error. A more serious objection is due to the fact that whereas the magnetic effect, and hence the sensibility of the instrument, depends on the difference of the currents in the two opposing coils, the space occupied by the coils is determined by the necessity for providing for the two large and nearly equal currents. *London Electrician*, Oct. 11, '95; *Elec. World*, Oct. 26, '95.

Energy Loss in Dielectrics. By P. Gasnier. Writer concludes that from all the experiments which he enumerated, the existence of dielectric hysteresis analogous to magnetic hysteresis has not up to the present time been demonstrated, which leads one to the conclusion that it does not exist. *London Electrician*, Nov. 1, '95.

Water Rheostats. By Geo. T. Hanchett. Writer gives some practical suggestions concerning the use of water rheostats. *Elec. World*, Nov. 6, '95.

Variation in the Electrical Resistance of Bismuth when Cooled to the Temperature of Solid Air. By James Dewar, M.A., F.R.S., and J. A. Fleming, D.Sc., F.R.S. From the *Philosophical Magazine* for Sept., '95. Descriptions of experiments and tabulated results. *Electricity*, Nov. 6, '95

Simple Principles and Use of Electric Measuring Instruments. Discussion of amperemeters, voltmeters, delicate mirror galvanometers and resistance coils. *London Elec. Engineer*, Nov. 8, '95.

Methods and Instruments Employed in Climbing Electric Posts. An interesting description of the various methods employed in different countries to climb poles. *Western Electrician*, Nov. 9, '95.

A Suggestion for a Dynamometer. By Geo. T. Hanchett. Some heavy timbers—heavy in proportion to the machine to be tested—a little hardware and a platform scale, or with smaller appliances a spring balance are the necessary requirements. Illustrated description with calculation for foot pounds appeared in *Elec. World*, Nov. 16, '95.

Theory of Dimensional Formulas. By Percy H. Thomas. Some additional remarks to clear up the discussion, which appeared some months ago. *Elec. World*, Nov. 23, '95.

Insulation of Overhead and Underground Circuits, having a Difference of Potential of 2,000 Volts and Over. By Capt. Wm. Brophy. The writer expresses his views concerning overhead construction. He believes it more dangerous to have poorly insulated wires than no insulation at all, but also believes that companies using high voltages could advantageously bury their wires and save money in the end. *Electricity*, Nov. 27, '95; *Elec. Engineer*, Dec. 4, '95.

Crompton Potentiometer, Its Use and Capabilities. By W. C. Fisher. The first of a series of articles. Some notes and suggestions on the handling of this instrument. *London Electrician*, Nov. 29, '95.

Variation in Electrical Conductivity of Metallic Wires in Different Dielectrics. By Fernando Sanford. Treated in *Physical Review*, Nov.–Dec., '95; *Electricity*, Dec. 4, '95.

A Lightning and Heavy Current Arrester. An illustrated description of a current arrester, charge grounder, open circuit alarm, automatic live wire tester, intended to protect telegraph, telephone, fire alarm, call bell and all low potential instruments that are liable to damage from lightning and live wires. *Scientific American*, Dec. 7, '95.

Formulas for the Calculation of Return Loop Circuits. By Edwin R. Keller. Paper read before the October meeting of the Franklin Institute. After pointing out that an absolute uniformity of potential cannot practically be attained by this system, he discusses which of several of its modifications will give the most satisfactory results in a specific case considered. *Elec. World*, Dec. 7, '95.

Simple Method for Measuring Insulation Resistance of Accumulators, which method can also be used on a complicated network while current is flowing, is explained in *Elektrotechn. Anzeiger*, Dec. 1, '95.

The Crompton Improved Bifilar D'Arsonval Galvanometer. This instrument, when adjusted for maximum sensibility, will produce one centimetre deflection on a scale 200 cm. from the instrument by one-millionth of a volt. Given in detail in *London Elec. Engineer*, Dec. 13, '95.

Speed Voltage Curves. By A. Griffiths, B. Sc. An article with graphical and analytical illustrations, explaining rapid or sudden changes in the rise of electromotive force or pole difference of potential in dynamos. *London Electrician*, Dec. 20, '95.

Electric Registering Water Level Indicator. A very minute and well illustrated description of an apparatus which gives a signal every time that a positive or negative variation of some importance occurs in the level of the reservoir. *Scientific Am. Supplement*, Dec. 21, '95.

The Crompton Potentiometer. Description of instrument, abstracted from a paper by W. C. Fisher, in *London Electrician.* See *Electricity*, Dec. 25, '95.

MINING.

Electric Power in Mines. A description of a mining hoist lately established in a western mine. *Power*, Dec., '94.

Electricity in Coal Mining. By W. A. May. A successful haulage and pumping plant. Description of the electrical machinery at Forest City, No. 2 Colliery, and a statement of the results accomplished. *Colliery Engineer*, Dec., '94.

The Successful Application of Electricity to the Operation of Mines. A comparative table of cost between electrical and steam plant with reasons given for the great difference in maintenance in favor of electricity and *vice versa* for the difference in first cost in favor of steam. These data refer to plants actually installed by Mr. W. F. C. Hasson. *Elec. World*, Dec. 8, '94.

Electric Haulage. Under this heading we find a description with illustration of a Jeffrey Electric Mine Locomotive. *Am. Man. and Iron World*, Dec. 21, '94.

Electrical Pumps. By J. Berthon. The paper consists of two parts, the first pointing out the advantages connected with an electrical motor; the second treating of the method of regulating a motor. *L'Électricien*, Dec. 29, '94.

Rotary Electric Drills. By G. Lestang. An illustrated description of the Thomson-Houston drill, as used in the French mines. *Revue Industrielle*, Jan. 5, '95.

Electricity as Applied to Mining. By G. S. Corlett. Paper read before the Northern Society of Elec. Engineers. The author discusses the application of signalling, telephoning, blasting, lighting and transmitting of power. *London Elec. Engineer*, March 1, '95.

Electrical Pumps. By J. Berthon. Description of an electrically controlled high pressure pump (Beer system). *L'Electricien*, March 2, '95.

Goulds Electric Mine Pump. An illustrated description. This pump was manufactured principally to get a compact form of pump. *Am. Manufact. and Iron World*, March 22, '95.

Applications of Electricity to the Mining Industry. Electric drills. Description of a number of French and American machines. *L'Electricien*, April 27, '95.

Electricity in the Quarries of Euville. Work is being done with a commercial efficiency of 63.36 per cent. A comparative table of compressed air and electricity is strongly in favor of the latter. *Western Electrician*, May 18, '95.

Electrical Mining Machinery. Hauling, pumping and drilling accomplished by electricity. A description of the electrical machin-

ery at Mt. Lookout Colliery, near Wyoming, Luzerne Co., Pa. *Colliery Engineer*, July, '95.

Electricity at the Mining Exposition, Santiago, Chili. By Harry Bindemann. Description of the principal exhibits. *Elec. Engineer*, July 3, '95.

Electrical Transmission of Power With Special Reference to Mining Operations. By H. T. Haws. *London Electrician*, July 19, '95; ELECTRIC POWER, September, '95.

Water Power Applied by Electricity to Gold Dredging. By Robert Hay. From the proceedings of the Inst. of Civil Engineers. Description of the first plant installed in New Zealand. *Electricity*, Sept. 4, '95.

Electricity in Gold Dredging. By Ralph L. Montague. Description of machinery and method employed. *Electrical World*, Sept. 21, '95.

A Central Station in Mining Work. By Timothy W. Sprague in the *Engineering and Mining Journal.* Description with illustrations and maps showing the application of electricity in mining from a central station. The plant has been put in operation at Scott Haven, Pa. *Elec. Review*, Sept. 25, '95.

Electricity in Gold Dredging. By Ralph L. Montague. Description of a gold dredging plant in Montana. *Elec. Plant and Elec. Industries* (London), Nov., '95.

RAILWAYS.

The Commercial Possibilities of Accumulators for Tramcar Traction Considered as a Municipal Undertaking. By A. H. Gibbings. See under "Storage Batteries."

Ithaca Street Railway Plant. Description of same taken from *Sibley Journal of Engineering* for Nov.; *St. R'y Gazette*, Dec. 1, '94.

Underground Conduit Electric Railway in New York. Reference to and sectional view of Lenox Avenue conduit. *St. R'y Gazette*, Dec. 1; *Elec. Age*, Dec. 22, '94.

The Electromagnetic Traction Company's Underground Railway System. This system is used in Washington, D. C., and an illustrative description taken from the *Elec. Engineer* is given in *St. R'y Gazette*, Dec. 1, '94.

Electric Traction, with special reference to the Installation of Elevated Conductors. By Robert W. Blackwell and Philip Dawson. Abstract of a paper read before the London Institution of Electrical Engineers. The writers first speak of rail bonding, then of corrosion, refer to welding but are of the opinion that it has not been sufficiently tried. Description of the Portland, Ore., three-wire system; statistics of the maximum load on the line in Chicago, and other interesting data. *St. R'y Gazette*, Dec. 1, '94.

The Sag in Span and Trolley Wires. By E. A. Merrill. A series of carefully conducted experiments on sag in span and trolley wires, with diagrams representing: 1. Dip or Sag in Span Wires, Single Track; 2. Dip or Sag in Span Wires, Double Track; 3 Dip or Sag of No. 0 B. & S. Trolley Wire (copper) in a span of 125 feet and with varying Tensions; 4. The same with varying Temperatures. The paper also gives some empirical formulæ. *Elec. World*, Dec. 1, '94.

Electric Railway Work in Chicago. A short description with a map showing electric railways in Chicago. *Elec. Engineer*, Dec. 5, '94.

East Boston Electric Railway Power Stations. Abstract from the *Engineering Record*. Description of a small new plant with section and plan of the New East Boston Electric Railway Power Stations. *Elec. Engineer*, Dec. 5, '94.

Notes on Electric Tramways in the United States and Canada. By H. D. Wilkinson. Abstract of a paper read before the London Institution of Electrical Engineers. A review of the average cost of installations, construction of roadbeds and tracks, return circuit, uniform distribution. *Elec. Engineer*, Dec. 5, '94.

Electric Street Railways in Detroit, Mich. A new railway to be installed and run in opposition to the Citizens' Company. *Elec. Engineer*, Dec. 12, '94.

Notes on Economy Tests of Electric Railway Plants. By Geo. H. Davis. The writer gives a number of valuable suggestions as to the manner in which tests should be made. *Elec. World*, Dec. 1; *St. R'y Gazette*, Dec. 15, '94.

Present and Prospective Development of Electric Tramways. Read before the Society of Mechanical Engineers, New York, December 6, 1894. By C. J. Field. After a short historical review the writer discusses: 1. The Roadbed; 2. Track Bonding and Electrolysis; 3. Line Construction; 4. Feeder Wire; 5. Underground Conduits; 6. Cars and Their Equipments; 7. Motor Equipments; 8. Power House; 9. Car House; 10. Operating Expenses and Cost of Equipment. *Elec. Review*, Dec. 19, '94, and subsequent issue.

Electrical Steep-grade Traction in Europe. By C. S. Du Riche Preller. Paper read before the Institution of Electrical Engineers, London, Nov. 22, 1894. The writer places before the Institution a short synopsis of what has been done in Europe in that branch of engineering, together with certain conclusions and proposals founded on his own experience. *St. R'y Gazette*, Dec. 22, '94.

The Electric Braking of Motor Cars. By W. Nelson Smith. Part I. An illustrated description of the manner in which a car motor may be turned with a generator and the power thus generated act on the brake. *St. R'y Gazette*, Dec. 22, '94.

The Montreal Street Railway System. After a short introduction and besides a number of illustrations, the following points are described: Power station, boilers, engines, dynamos, switchboard, overhead construction, tracks, repair shops and car barns, rolling stock, financial. *Elec. Engineer*, Dec. 26, '94.

Conduit versus Trolley. By Joseph Sachs. Besides presenting a critical review of the various systems of traction, the writer shows a number of interesting illustrations. ELECTRIC POWER, Jan., '95.

New Power Station of the Consolidated Traction Company of New Jersey. The station will have an 8,000 horse-power capacity. Each engine will be direct connected to a Westinghouse multipolar generator. The plan of station and track, general plan of piping, plan and elevation of engine piping, shown and described in *St. R'y Journal*, Jan., '95.

Electric Street Railway at Alsnon, Ohio. A description of 22 miles of single track road; 55 cars, of which 29 are motor cars. 50 per cent. of the road is on grades varying from 4 to 11½ per cent. Cars, method of suspending motors, the interior of the motor with armature removed, the series parallel controller used with the equipments of these cars are subject to illustration. *Elec. Industries*, Jan., '95.

The System of the People's Traction Company, Philadelphia. A fourteen page description, with views and diagrams, the principle ones being a coal elevating plant, Delaware Avenue power station, sections thereof, engine room, plans of boilers and engines, car houses, air pump engine, sections of track, Peckham truck and

Sperry motor, plan and section of man-hole, etc. *St. R'y Journal*, Jan., '95.

Proposed Underground Sectional Electric Railway at Belleville. An illustrated description of the so called E. M. system, which is a contact system in which the circuit is only closed when the trolley wheels, of which there are two on each car, pass over the section of conductor and pick up the electric current for the motor. *Can. Elec. News*, Jan., '95.

Some Recent Fenders for Street Cars. A description of a number of the latest devices. *Engineering Record*, Jan. 3, '95.

Controllers. By Frank B. Lea. It seems that the controller as it is used in this country, is not very well known in England. The writer gives a short description and points out the various advantages of the same. *London Elec. Engineer*, Jan. 4, '95.

Electric Traction in Europe. By Philip Dawson. According to this paper, England and the Continent are commencing to make progress in the introduction of the trolley. In European electric traction, Germany is an easy first, having already 180 miles of track electrically equipped, over 630 cars, and more than 8,000 station engine horse power in operation. The unnecessary restriction to a 300 volt circuit is referred to, as no possible advantage is gained from this limitation. *London Elec. Review*, Jan, 4, '95.

The Present Position and Prospects of Electric Traction in this Country. (England.) By M. Holroyd Smith. An article on the subject in general. It seems very remarkable that the English writers must always refer to American roads. In this article the writer says: "The roads in England are usually so good that ordinary vehicles can safely and easily be run upon them, whereas in America it may be said that, as a rule the roads are so abominably bad that the only safe means of vehicular traffic is the tramway. The influence of this is much greater than the British public can fully realize." *London Elec. Review*, Jan. 4, '95.

The New Power Station of the Lindell Railway Company, St. Louis. Complete description of power station, water service, coal supply, boiler room, wire tower, switch board, steam distribution, etc. *Western Electrician*, Jan. 5, '95.

The System and Power House of the Fair Haven and Westville Railroad, New Haven, Conn. A complete description of plant, giving illustrations and sectional views of the various vital parts of the system. *Elec. Engineer*, Jan. 16, '95.

Conduit versus Trolley. By Joseph Sachs. The second of a series of articles. It deals with the Open Slot Continuous Wire Conduits and Flexible or Movable Cover Conduits. ELECTRIC POWER, Feb., '95.

The System of the Binghamton Railroad Company. This company now owns all the street railway lines in Binghamton. A complete description of this plant, with various views, is of especial interest, as Binghamton was the first city in New York State in which an electric railway was installed. *Street R'y Journal*, Feb., '95.

The Electric Railway Development of Staten Island, N. Y. By Chas. H. Cochrane. A map showing existing and proposed roads. *Elec. Engineer*, Jan. 6, '95.

Power Plant of the Cleveland Electric Railway Company. Illustrated description of the same. *Power*, Feb., '95.

The Brott Electric Bicycle Railway. A description of the proposed elevated road which is to run one hundred and twenty-five miles an hour between Washington and New York. *Inventive Age*, Feb., '95.

Electric Railway Work in Germany. The trolley is gaining ground in Germany. An itemized account of the first German installation, that of Halle, shows total operating expenses per car mile, $.0558, and ratio of operating expenses to receipts 59 per cent. *Street R'y Journal*, Feb., '95.

A Table of Statistics. Comparison of the mileage and cars of street railways in the United States for the year ending December, '93 and '94. The total number of miles for '93 was 12,434; for '94, 12,527. Total number of cars for '93, was 40,815; for '94, 41,668. *Street R'y Journal*, Feb., '95.

Economic Street Railway Maintenance.—The Repair Shop. By Keppele Hall. The writer points out the importance of a proper system in repair shops, and shows how to handle repairs. *Elec. World*, Feb. 2, '95.

Street Railway Overhead Appliances. By A. G. Eneas. Suggestions for draughting specifications for line appliances; principally: the Common Ear; Strain Ears; Feeder Ear; Feeder Bolts; Double Curve Pull Off. *Elec. World*, Feb. 2, '95.

Electric Railways in New Hampshire. At the request of the New Hampshire Legislature, the Railroad Commission of that State has just made a special report on the electric railways of the State. The Commission closes its report by recommending a general law to cover the whole subject of granting franchises to electric railroad companies. It says:

1. Authorize the organization of street railroad corporations by some simple and easy method, and the construction of such roads wherever and whenever they are needed by whoever will furnish the necessary means.

2. Provide an impartial and competent tribunal to determine the question whether the public good demands the construction of a proposed road, and to fix the compensation, if any, for the use of highways.

3. Confer upon the towns and cities through which a road runs the authority to locate it, prescribe the character of its construction and, in cases where it is confined to one town or city, the method of its operation.

4. So far as it is practicable, to exclude such roads from the traveled highways in country districts and secure to the public, directly or indirectly, compensation for the property and privileges which are granted them.

5. Protect grade crossings.

6. Declare that failure to operate a street road shall be a forfeiture of its franchise.

7. Prohibit fictitious capitalization, the sale of securities for less than their par value, and the contraction of debts in excess of the amount of capital stock actually paid in.

Western Eletrician, Feb. 9, '95.

Underground Street Car Systems. A description of three systems: the Buda Pesth, Hoerde and Looc. Sectional views of the various systems accompany the descriptive part. *Elektrotechn. Anzeiger*, Feb. 10, '95.

Low Rail Joints of Street Railways and their Prevention. By N. S. Amtutz. The writer points out in some detail the causes for difference of bent between the adjoining ends of rails; he urges a prevention by careful and frequent inspection. *Electricity*, Feb. 13, '95.

Conduit vs. Trolley. By Joseph Sachs. The third of a series of articles, dealing with the surface contact systems. ELECTRIC POWER, March, '95.

Power Station of the Nassau Electric Railway Company, Brooklyn, N. Y. Illustrated description of installation. *Street R'y Gazette*, March 2, '95.

Rail Bonding and its Bearing on Electrolytic Corrosion. By Geo. P. Low. See Synopsis of April, under "Electro-Chemistry"; also *Street R'y Gazette*, March 2, '95.

Monte Salvatore Electric Cable Railway. The motors that operate the cable winding machinery derive current from water power station five miles distant, which supplies power not only to the railway, but to a mill, and for lighting the towns Lugano and Capolago. The water power available is at an efficiency of 80 per cent. 1.070 H. P. *Street R'y Gazette*, March 9, 95.

Safety Gates at Minneapolis. The cars are being equipped with gates which can only be opened and closed when the cars have come to a complete stop. Description and illustration appears in *St. R'y Review*, March 15, '95.

The Reliability of Gas Driven Street Railways. A short account of a number of successful systems run in Germany during the last winter. The various reports points out that the gas driven street cars kept up the service uninterrupted, while trolleys in the neighborhood were stalled by severe weather. *Progressive Age*, March 15, '95.

Commercial Advantage of Quick Stops. By actual experiments made, it was found that it takes 1.8 seconds more out of the schedule time to make a slow stop than it does to make a short one. Perhaps this seems like very little saving, but a car running 150 miles a day and stopping five times to a mile, stops 750 times a day. At 1.8 seconds saving per stop, 22 minutes are saved on a day's run, and the car's earning capacity is increased by that much. *Street R'y Review*, March 15, '95.

Electric Railway System at Binghamton, N. Y. A complete and well illustrated description of the plant. *Elec. Industries*, March, '95.

Railway System of Buffalo. Illustrated description. *St. R'y Journal*, March, '95.

Lyons Oullin's Electric Street Railway. This is the fifth road in France to adopt the overhead system. See detail in *St. R'y Journal*, March, '95.

Manufacture of Modern Electric Car Wheel. By P. H. Griffin. This is a very interesting paper inasmuch as it throws some light on a subject to which few people attach the value it deserves.

In considering the different parts of the wheel, there is no more important problem to be solved than the question of flanges, because the flange section must be very small and light compared with that used on steam railways, the latter having four times as much material in it as the former, although wear in the electric is much more severe than in steam service. *St. R'y Journal*, March, '95.

A Perfect Rail Bond. By Harold P. Brown. A description with comparative results of the "Plastic Rail Bond." The experiments made lead the writer to the conclusion that no road using copper bond wires can be operated with proper economy of power. *Street R'y Review*, March 15, '95.

A Good Record from Minneapolis and St. Paul. An annual report, of which was given a small abstract in cents per car mile for the year 1894.

Repairs to armature per motor mile	$.0010.
" " motors " " "	.0041.
" " cars " " "	.0035.
Maintenance of equipment per motor mile	.0086.
Repairs to armature " car "	.0008.
" " motors " " "	.0036.
" " cars " " "	.0030.
Maintenance of equipment " " "	.0074.

Street R'y Review, March 15, '95.

Electrical Street Railways in Philadelphia. An abstract of a number of articles which appeared in the *Elec. World.* See *Elektrotechn. Zeitschrift*, March 21, '95.

Buffalo Street Railway Power Plant. By Frank C. Perkins. The details of this 6,000 H. P. plant are given in *Western Electrician*, March 23, '95.

Electric Railways at Havre. A short explanation of the trolley lines installed, with views of the streets. *Elec. Industries*, April, '95.

The Street Railway System of Boston. A very complete, well illustrated description of this vast network of roads. *Street Railway Journal*, April, '95.

An English Comparison of Cables and Electricity. Leeds, England, is debating the relative merits of cable and trolley, and the City Engineer in a recent report sets forth the relative advantages in a statement very nearly correct, as follows:

For the cable: No unsightly poles, cross wires or trolley wires;

no sparking; less wear of metals, load being less; more silence on the road; no buzzing of motors; no danger from falling wires; a large number of extra cars can be put upon the road to meet an emergency at a very slight increase of cost.

For the electric cars: No central slot to catch horses' shoes; only two rails for wheels to skid against; all power generated is utilized; electric cars may be run with varying speeds, making up for lost time; cable mode of construction involves repairs and interference with the traffic on the street; electric cars can move backwards if necessary; a broken or blocked cable stops the whole system; brake power failing on a decline, control is maintained over the electric car by reversing the motor; cars lit by electricity are more comfortable and convenient; electric overhead system has a greater field for improvement open to it with regard to cost than the cable system has. *St. R'y Review*, April, '95.

Electric Railways and Underground Pipes. By Dr. Rasch. An interesting paper, in which the writer discusses the various views and results given by some American writers on the subject from the German point of view. *Elektrotech. Zeitschrift*, April 4, '95

Buda-Pesth Underground Railway System in Washington, D. C. The Metropolitan Street Railway Company of Washington is constructing an underground system, substantially on the plans of the Buda-Pesth road. *Elec. Review*, April 10, '95.

Some Methods of Collecting the Energy in Electric Railways and Tramways. By M. Holroyd Smith. Paper read before the Northern Society of Electrical Engineers, April 8, '95. The author first enumerates the following conditions pertaining to the collector: 1. Provision for making and maintaining contact between the motor on the car and the supply conductors, whether that be overhead or underground; 2. the avoidance of damage, either electrical or mechanical, should the collector become blocked or leave the track; 3. the collector must be able to take the points at turn-outs, and traverse crossings without fouling them or short-circuiting; 4. the collectors must be so insulated as to be safe to handle, and avoid leakage; 5. no danger or damage to the public must result from their use; 6. they must be simple and durable, and the working parts must be cheap to renew.

He then continues to discuss the principal devices in their chronological order. *London Elec. Engineer*, April 12, '95.

Trolley Mail Service for Boston. Arrangements have been completed for the introduction of a mail service on the West End Street Railway in Boston. It is estimated that the new mail cars will cover about 390 miles daily, or 130,000 miles annually. *Street R'y Gazette*, April 13, '95.

The Lenox Avenue Conduit System of the Metropolitan Traction Company. Description of plant, with illustrations of the trolley to be used; the interior of the car house, showing pit and conduit; a general view of the power plant, and finally a plan and cross-sections of track construction of Lenox Avenue Conduit Railway. *St. R'y Gazette*, April 13, '95; *Elec. Review*, April 17, '95.

Conduit vs. Trolley. By Joseph Sachs. The fourth of a series of articles containing description of sectional conductor slotted conduit systems, also raised contact systems, induction and miscellaneous systems. ELECTRIC POWER, April, '95.

Break-Down Tests on Railway Line Material. By Geo. F. Sever. These tests seem to indicate that with the highest allowable difference of potential, *i. e.*, about 1,200 volts, there is little danger from actual break-down, the leakage over thoroughly wet surfaces being a much more serious consideration, especially so in the case of a large network of overhead line and material. ELECTRIC POWER, April, '95.

The Electric Railway for Interurban Traffic. By Ralph W. Pope. The writer points out principally the various advantages to be derived from trolley systems in the suburbs, especially as regards their superiority over the steam roads. ELECTRIC POWER, March, '95; copied in *St. R'y Gazette*, April 20, '95.

Car Fender. Illustration of a fender, invented by W. A. Donor, Jersey City. *Am. Machinist*, April 25, '95.

New Power House of Columbus Central Railway Co. Full description with map of line. *Elec. Industries*, May, '95.

Street Railway System at Hartford, Conn. Description of power station, engines, lubrication, switchboard, boiler room, stack, street-construction, bonding, rolling stock, electric heaters, and car house. *Street R'y Journal*, May, '95.

Power Station and Car House of the Steinway (N. Y.) Railway Company, Long Island. Plan views of direct connected unit and piping, power station arranged for six belted generators, cross-sections of belted engine, boiler room and car house. *Street R'y Journal*, May, '95.

Local Road at Gmunden. Although a very short road, this new installation is of interest inasmuch as the ground is exceptionally hilly. The grade is at times 95 per mille. The overhead trolley is used. *Elektrotech. Anzeiger*, May 2, '95.

North Hudson County Railway of Hoboken, N. J. This company operates about 83 miles of electric, horse and steam railways; a complete description, well illustrated, appears in *Street R'y Gazette*, May 4, '95.

Metropolitan West Side Elevated of Chicago. A well illustrated article with probably the most careful description that has yet been furnished. *St. R'y Review*, May 15, '95.

The Electric Tramways of Boston. By G. Pellissier. A careful description of the system, well illustrated with plans and charts. *L'Eclairage Electrique*, May 18, '95.

Three-Phase Street Railway Plant. A number of three-phase machines are installed; generating current at from 2,500 to 3,000 volts at a periodicity of 30 complete cycles per second; three machines are 120 kilowatts each. At sub-stations are synchronous motors. *Street R'y Gazette*, May 25, '95.

Comparative Value of the Rheostat and Series Parallel Method of Car Control for a Particular Case. By George F. Sever. The primary object in carrying out these tests was to enable an accurate comparison to be drawn between the two distinct methods of car control under widely varying conditions, these latter being the operation of cars in crowded city traffic and on long runs where stops were infrequent. The results of the tests are given in form of charts and tables. ELECTRIC POWER, May, '95.

Railroad Patent Litigation, the Under-Running Trolley. Final hearing of a case involving the Basic patent of a modern trolley. *Electricity*, May 29, '95.

First Permanent Electric Elevated Railway System in America. A complete account of the construction of the Metropolitan Elevated in Chicago. *Elec. Industries*, June, '95.

Electric Railways and Tramways in Great Britain. By Albert H. Bridge. The writer speaks of the slow development of the electric railway in England, but thinks the year 1895 memorable as bringing about changes in favor of electric propulsion. *St. R'y Gazette*, June 8, '95.

Sectional Surface Contact System. By M. Jacquine. Description of the Railway system in Lyons, with special mention of two systems for preventing accidents. *L'Eclairage Electrique*, June 8, '95.

Railway Enterprise in Egypt. By Frederic C. Penfield, Consul General at Cairo. A short description of the development of the railway system. *Elec. Review*, June 12, '95.

The Interurban Electric Railway. By S. H. Short. Paper read before the Cleveland Electric Club, May 22, '95. Author discusses the various points developed in trolley roads, from the side of the practical working; making an effort to care for both the comfort of the passengers and the assets of the company. *St. R'y Review*, June 15, '95.

Electricity or Steam? By H. G. Prout. The writer shows that in his opinion we are far from introducing electricity successfully in place of steam roads at the present time. New York *Independent*, June 6, '95; copied in *Elec. Engineer*, June 19, '95.

Electric Locomotives and Railways. A historical review of their development. *London Engineering Review*, June 20, '95.

Westinghouse Electromagnetic System for Railways is described and illustrated in *St. R'y Gazette*, June 22, '95.

A Method of Electric Traction for Tramways in Towns—The Thwaite-Cawley System. By George Cawley. Paper read before the Tramway's Institute of Great Britain and Ireland. Author starts with a review of the work that has been accomplished in the United States. The article is to be continued. *London Elec. Engineer*, June 28, '95.

Trolley and the Death Roll. By Townsend Wolcott. Writer tries to put before the reader in an impartial manner who is to blame for the many accidents that have of late occurred. ELECTRIC POWER, July, '95.

Will Trunk Lines be Operated by Electricity. By Frank J. Sprague. The writer points out in an impartial manner the possibilities and limitations of the electric locomotive. *Engineering Magazine*, July, '95.

Substitution of Electricity for Steam in Railway Practice. By Dr. Louis Duncan. Paper read before the Am. Inst. of Elec. Engineers, July 27, '95. Dr. Duncan drew the following conclusions: 1. The tendency of passenger transportation on the steam lines has been in the direction of greatest electrical economy, while the tendency of the freight transportation has been in the direction of the least electrical economy; 2. It will not pay any through line with considerable traffic, having two tracks, to equip their main tracks electrically; 3. With four track roads it will pay to equip all of the tracks electrically, unless a considerable portion of the business is through passenger traffic; 4. It will pay all the larger roads either to equip a number of their branch lines electrically, or to control competing electric lines; 5. In order to remain on a dividend paying basis, it is imperative that most of the two track lines either build additional tracks or control the electric roads that parallel them; 6. Believing that ultimately all of the traffic will be done by electricity, it is imperative that the managers of steam roads keep constantly in touch with electrical progress. *Elec. Review*, July 3, '95; *Elec. Engineer*, July 3, '95; *Electricity*, July 3, '95; *Elec. World*, July 6, '95; *Elec. R'y Gazette*, July 6, '95; *Am. Machinist*, August 1, '95.

Early History of Electric Traction. By I. William Chubb. This article is historical and dwells considerably on American developments. *Practical Engineer*, July 5, '95.

The Baltimore Belt Line Tunnel. A description of the overhead conductors and the line construction. *Elec. Review*, July 17, '95.

New Jersey Electric Railway Company. Description of an important part of a trunk line, 50 miles in length. *Elec. R'y Gazette*, July 20, '95 continued in subsequent issues.

Electric Brake. Illustrated description of a patented brake is furnished in *Elec. R'y Gazette*, July 22, '95.

Accumulator Traction in Paris. Results of a number of tests are given in *Elec. R'y Gazette*, July 6, '95; see also an article by J. Sarcia in *Electricity*, July 24, '95.

Electricity on the Nantasket Branch of N. Y., N. H. & H. R. R. This is not the first instance in which seaside trains have been moved by use of the trolley, but it is the first in which the motors and cars have been of such size and weight and power as to approach the conditions of ordinary railway traffic. Description given in *Am. Machinist*, July 25, '95.

Chicago Electric Elevated Railway. A short review explaining how the enterprise was called into existence, and several views of the power plant. *Elec. World*, May 4, '95.

Statistics of the Railroads of the United States for Year Ending June 30, 1895. From an abstract of the Seventh Statistical Report of the Interstate Commerce Commission, covering the above period, we take the following interesting figures:

Total mileage, U. S., June 30, 1894	178,708.55
Mileage constructed during year	2,247.48
Number of railroad corporations	1,924
Locomotives (passenger)	9,893
" (freight)	20,000
" (switching)	5,086
" (unclassified)	513
" (total)	35,492
Cars (passenger)	33,018
" (freight)	1,205,169
" (company's service)	39,891
(The above figures do not include cars owned by shipper or private individuals.)	
Increase during the year, locomotives	704
" " " " cars	4,132
Passengers carried per passenger locomotive	62,639
Pass. miles per passenger locomotive	1,444,400
Tons carried per freight locomotive	31,909
Ton-miles " " "	4,016,755
No. passenger cars per 1,000,000 passengers	53
" freight " " " tons freight	1,888
Locomotives fitted with train brakes during the year	1,579
Cars " " " " " "	30,386
Locomotives " " auto. couplers " "	1,197
Cars " " " " " "	34,186
Percentage of total equipment fitted with train brakes	25.20
Percentage of total equipment fitted with automatic couplers	27.23
Total number of employees, June 30, '94	779,608
Decrease during year (10.76 per cent.)	93,994
Capitalization: total reported June 30, '94	$10,796,473,813
" per mile of line	62,951
Stock paying no dividends (63.43 per cent.)	$3,066,150,094
Average rate of dividend on paying stock	62,951
Passengers carried	619,688,199
" " (increase over previous year)	26,127,587
(This increase was caused by World's Fair travel.)	
Average No. passengers to train	44
Average distance traveled by passengers (miles)	23.06
Tons of freight carried	638,186,553
Decrease from previous year	106,932,929
Average No. tons to a train	179.80
Average haul of one ton (miles)	125.88
Gross earnings	$1,073,361,797
Operating expenses	$731,414,322
Employees killed	1,823
" injured	23,422
Passengers killed	324
" injured,	3,304

One employee killed out of each 428 employed.
" " injured " " " 33 "
" passenger killed " " " 1,912,618 carried.
" " injured " " " 204,248 "
" " killed for each 44,103,228 miles traveled.
" " injured " 4,709,771 " "

Railroad Car Journal, July, '95.

Electric Conduit System of the New York Third Avenue Company. The distance of eight blocks will be equipped with the Love conduit system as an experiment. *Elec. R'y Gazette*, Aug. 10, '95.

Test of an Electric Railway. By A. Langstaff Johnson. Some interesting results were obtained which the author gives in form of a table and a profile of the road. *Elec. R'y Gazette*, Aug. 10, '95.

Employment of Two or Several Motors on Cars or Locomotives, with Respect to Skidding. By Paul Hoho. Independent of the question of efficiency, which is diminished in a very great proportion, other conditions in certain cases militate against the simultaneous employment of two or several motors in the same car or on the same locomotive, or even on the same train. Author examines the question more particularly from the point of view of the slipping or skidding of the wheels, which can result from the combined action of the motors. The conclusions which follow are unfavorable to this disposition in cases more numerous than would appear at first sight. *Elec. R'y Gazette*, Aug. 10, '95.

Light Railways and Tramways. By R. H. Dorman, M.I.C.E., County Surveyor. A paper read before the Incorporated Assoc. of Municipal and County Engineers at Londonderry. A paper which discusses the subject as the author thinks it ought to be dealt with in Ireland. *London Elec. Engineer*, Aug. 30, '95.

Tramways in India. A short abstract from *London Railway World*, on the above subject. *Elec. Railway Gazette*, Aug. 31, '95.

Electric Car Tests. By Hermann S. Hering, M.E. Assisted by Chas. Reutlinger and B. Harrison Branch. These tests comprised a determination of the performance of electric cars of various kinds under definite conditions of load, speed, grade, track etc., with a view of obtaining empirical data for this condition which would at the same time have a fair degree of accuracy. After stating the general conditions affecting the performance of electric cars, the authors explain the instruments used and the methods pursued. Commencing with the road, they furnish a description of the same. Following this is an explanation of the general arrangement in the power station and this first section closes with an enumeration of the tests made.

These tests are then treated in detail in the following issues. The following is a list of these tests: (1) determination of the traction coefficient of the car used in the test; (2) determination of the performance of the cars run over the entire car route, with no other cars on the road at the time; (*a*) Pikesville road, 1893, single track; (*b*) Pikesville road, 1894, partly double track; (*c*) Lake Roland Road, 1894. (3) Determination of the performance of several different cars on uniform grades, at steady speeds and under various loads and controller positions; (4) determination of the performance of the same cars run on both of the roads over the entire car route under similar and also under different conditions; (5) determination of the performance of the same and other cars while running in regular service. *Elec. Railway Gazette*, Aug. 31, '95, and subsequent issues.

Detroit Citizens' Street Railway. A full description with plans of the new work of this company. *Street Railway Journal*, September, '95.

Operation by Electricity of the State Street Cable, Chicago. An account of the operation of the cable railway machinery by an electric motor, with detailed figures of power consumed. *Street Railway Journal*, September, '95.

Power Transmission and the Electric Railway. By Louis Bell, Ph.D. A presentation of the problems before us concerning the reduction of costs of installation in extending our suburban electric railways. *Street Railway Journal*, September, '95.

Western Avenue Power Station of the North and West Chicago Street Railroad Company. A station having an aggregate capacity of 20,000 indicated horse power and 15,000 kilowatts electrical output. *Power*, September, '95.

Electric Car Wiring. Diagrams representing the various positions of a series parallel controller, taken from an illustrated lecture delivered by Daniel O'Mahoney before the Brooklyn Electrical Society. *Elec. Engineer*, Sept. 4, '95.

Economic Size of Feed Wires for Electric Railways. By W. F. C. Hasson. A mathematical calculation which leads to the result that a theoretical economy will be obtained by the loss of 100 volts when the distance becomes 30,600 feet from the station. *Elec. World*, Sept. 7, '95.

Montreal Street Railways. The first of a series of articles describing the street railway system of Montreal in a popular way, with good illustrations. *Street Railway Gazette*, Sept. 14, '95, and subsequent issues.

Economical Equipment and Operating of Power House. By H. S. Newton. Read before the convention of the N. Y. State Street Railway Assoc., Sept. 17, '95. Speaker confined his remarks to the ways and means considered and adopted in the power house lately constructed at Syracuse. Paper with discussion in *Street Railway Gazette*, Sept. 21, '95.

Signals on Electric Railways. By J. H. Barnard. Paper read at the convention of the N. Y. State Street Railway Assoc., Sept. 17, '95. Author explains how to manage a single track system by means of signals so as not to retain cars too long and not to let them leave the turnout if a car coming the other way is on the track. *Elec. Railway Gazette*, Sept. 21, '95.

General Track Construction. By C. Loomis Allen. Paper read before the Street Railway Assoc. of the State of New York, Sept. 17, '95. Speaker pointed out the evolution which track construction has undergone and gives hints as to the proper way of doing the work at the present time. *Western Electrician*, Oct. 19, '95; *Elec. Railway Gazette*, Sept. 21, '95; *Elec. Review*, Oct. 23, '95.

Electrical Traction. The logic of facts. By Philip Dawson. The following interesting tables are taken from this paper:

TABLE I.—PROGRESS OF ELECTRIC, HORSE, AND CABLE TRACTION IN AMERICA.

	1890.	1891.	1892.	1893.	1894.
Mileage.—Total	9,037	10,599	11,665	12,186	12,527
" Electric	2,523	4,061	5,939	7,466	9,008
" Horse	5,400	5,302	4,460	3,497	2,243
" Cable	510	594	646	657	662
" Steam	604	642	620	566	614
Number of cars.—Total	32,108	35,877	37,399	40,499	41,668
" Electric	5,592	8,892	13,415	18,233	24,849
" Horse	21,970	21,798	19,315	16,845	11,507
" Cable	3,795	4,372	3,971	4,805	4,673
" Steam	751	815	698	616	639

TABLE II.—EUROPEAN ELECTRIC TROLLEY LINES ALREADY CONSTRUCTED, OR TO BE IN OPERATION DURING THE PRESENT YEAR.

	Miles of track.	No. of electric cars.
Germany	500	1,400
France	150	300
Great Britain	100	180
Austria Hungary	85	180
Switzerland	40	55
Italy	40	90
Belgium	25	50
Other countries	45	125
Total for Europe	985	2,380

TABLE III.—TOTAL OPERATING EXPENSES OF SOME EUROPEAN ELECTRIC TROLLEY ROADS PER CAR MILE.

Gera	2.97 pence.
Halle	3.51 "
Frankfort-Offenbach	4.51 "
Hanover	5.80 "
Hamburg	4.20 "
Breslau (paid 8 per cent. dividend)	4.36 "
Marseilles (paying 8 per cent dividend)	4 00 "
Leeds	5.00 "
Guernsey	5.79 "

TABLE IV,—TOTAL OPERATING EXPENSES OF SOME EUROPEAN HORSE AND STEAM ROADS PER CAR MILE.

Frankfort (horse)	9.50 pence.
Marseilles (horse)	6.12 "
Frankfort (steam)	6.92 "
Birmingham (average of four steam roads)	7.31 "
England (average per Duncan's Tramway Manual)	9.50 "

—*London Lightning*, Sept. 26, '95.

Tunbridge Wells Electricity Works. Description of installation in *London Elec. Engineer*, Oct. 4, '95.

How to Start a Car. Various methods and errors pointed out and illustrated by curves. *Street Railway Review*; *London Electrician*, Oct. 4, '95.

Street Railway Systems of Canada. A very elegantly illustrated article, with detailed descriptions of Montreal, Toronto, Quebec, Kingston, Niagara Falls and various other Canadian cities' railway systems. Souvenir number of *Street Railway Journal*, Oct., '95.

Different Methods of Operating Electric Railway Motors. The remarks which Mr. Steinmetz made in connection with Dr. Duncan's paper at Niagara Falls, is contained in *Elec. World*, Oct. 5, copied from the *Trans. of the Am. Inst. of Elec. Engineers.*

The Proposed Jungfrau Electric Railway. By V. M. Berthold. Description of line and proposed station. *Elec. Review*, Oct. 9, '95.

How to Throw on a Railway Generator. A simple description of the various steps to be taken. *Elec. Railway Gazette*, Oct. 11, '95.

Electric Traction on the Bristol Tramways. A complete account in *London Lightning*, Oct. 17, '95.

Overhead Trolley for Chicago's Down Town Business District. A centre pole line is being constructed, and views of the street appeared in *Western Electrician*, Oct. 19, '95.

Three-Phase Railway System at Lowell, Mass. The three-phase current generated at Lowell, is at a pressure of 5,500 volts, transmitted in part to a point about midway between Nashua and Lowell, and in part to a sub-station at Nashua itself. It undergoes at both these points, first a reduction of pressure in static transformers, and then a conversion from the three-phase current in a rotary converter, emerging upon the feeder and trolley lines at a direct current of 500 volts. For detailed description see *Western Electrician*, Oct. 19, '95.

The E. M. Conduit System. Description and illustration of the Electric Magnetic Traction Company's experiments in Philadelphia. The patents belong to Mr. James F. McLaughlin. *Elec. Engineer*, Oct. 23, '95.

Staten Island Electric Railway. Short description of the machinery installed and general outline of the works. *Elec. Railway Gazette*, Oct. 26, '95.

Diatto Conduit Railway System. A new conduit system, belonging to the class in which surface contacts with magnetic connecting devices are utilized, is illustrated in the cuts accompanying the article. *Elec. Railway Gazette*, Oct. 26, '95 ; *London Elec. Review*, Nov. 1, '95.

Third Avenue Company's Electric Conduit Railway in New York. The system is that of the Love Electric Traction Company in Washington. The station will have a capacity of 400 H. P., a 75 pounds rail, and the slot rails are made of riveted iron bar. *Elec. Railway Gazette*, Oct. 26, '95.

Model Electric Railway Plant. Illustrated description of the Fair Haven and Westville Electric Railroad in Connecticut. Seven lines of railroad are operated from one station, employing 38 open cars, 42 closed cars and 3 sweepers. The combined length of different

branches is 25 miles. Besides a map of the branches of the road and a view of the interior of the power house, a very interesting and instructive diagram giving the connections of the dynamos in the power-house accompanies the article. *Scientific American*, Oct. 26, '95.

Electric Street Railway at Bristol. Detailed description of plant. From *London Elec. Review*, translated in *Elektrotechn. Anzeiger*, Oct. 27 '95.

Berlin's Electric Tramway. The trolley system for urban traffic. In April, 1893, Messrs. Siemens & Halske entered into an agreement with the Pankow Council, whereby a concession for 50 years from the opening of the line was granted. Negotiations were then entered into with the Berlin Municipality, who, at the commencement, were hardly disposed to entertain the use of overhead wires; but in November, 1894, when the work in the Pankow district was well advanced, consent was given by the Berlin Council to the establishment of the desired section of the line in Berlin.

The overhead trolley wire is of hard copper, 8 mm. in diameter. It is suspended at a height of about 16 feet 6 inches, partly by means of transverse span wires attached to posts erected on the curbstone on each side of the street, and partly by means of bracket standards. The posts are steel tubes made on the Mannesmann system and are placed in cement concrete.

The collector is of the stirrup type, which renders unnecessary the use of special switching arrangements in the overhead construction. *Elektrotechn. Zeitschrift*, Oct. 31, '95; *Elec. Review*, Nov. 8, '95.

The Development of the Electric Locomotive. By John McGhie. An illustrated historical article. ELECTRIC POWER, Nov., '95.

Municipal Ownership of Street Railways. Two articles, one by Prof. Edward W. Bemis, in favor of, one by Mr. H. A. Foster, against, and one editorial by Max Osterberg, critizising the two previous ones, but leaning strongly in favor of municipal ownership. ELECTRIC POWER, Nov., '95.

Horseless Carriages. Description of carriages called the electrobat, which are to run with storage batteries. *Elec. Review*, Nov. 6, '95.

The E. M. Traction System. This is the invention of Mr. James F. McLaughlin. The details are explained and illustrated in *Elec. Railway Gazette*, Nov. 6, '95.

Overhead Feeder and Trolley Construction of the New Orleans Traction Company. By W. Nelson Smith, M. E. Accompanying the description is a map showing feeder trunk lines. *Elec. Railway Gazette*, Nov. 6, '95.

Losses in the Operation of Electric Railways. By Hermann S. Hering. The losses discussed in this paper are those due to defective roadway construction, to the manner of handling the controller, to stopping and starting, and to carrying additional weight on the car. *Elec. World*, Nov 6, '95.

Horde Conduit System. In the system which has been carried out at the Hörde Mining and Smelting Works, the aim has been to construct a conduit which shall be strong and cheap, and also readily accessible for repairs in both the drainage and trolley wire sections. A short experimental track on their conduit system has been constructed on the Hörde Bergwerks und Hüttenverein, in connection with their works, and in combination with a line worked on the ordinary overhead trolley system. The combination of these two systems resulted in showing that two such systems can easily be worked together, using the same cars throughout. This combined working, of course, necessitated that, in the Hörde system, the rails should, as in the ordinary trolley system, form the return conductor.

The Hörde system consists essentially of three parts: 1. A special track. 2. A trolley wire conduit. 3. A drainage conduit.

Detailed description with illustrations to be found in *London Elec. Review*, Nov. 8, '95; *Elec. Railway Gazette*, Nov. 30, '95.

A Storage Battery Railway in Chicago. A new enterprise, which is first taking hold in the southern part of the City of Chicago. *Western Electrician*, Nov. 9, '95.

No Seat, No Fare, in Europe. This sensational title is in fact simply a report made to the Mayor of the City Council of Chicago by C. L. Bonney, of the Chicago General Railway. It treats the requirements and principal regulations of the European street railway services, explaining the restrictions inflicted by the police and refers to the fares. *Electricity*, Nov. 13, '95.

Conduit Railway System of the Metropolitan Company of Washington. The first of a series of articles describing this new road. Some of the principal points are the following: Drop over a distance of four miles, five per cent.; road is operating 24 trains of two cars each, and coal consumed averages 12.600 pounds daily; there are three units in the engine room. *Elec. Railway Gazette*, Nov. 2, '95; *Elec. World*, Nov. 16, '95.

Steam and Trolley in Connecticut. By Clarence Deming, in the *Railroad Gazette*. A discussion of the relative advantages and disadvantages of introducing the trolley in Connecticut. *Elec. Review*, Nov. 20, '95.

Coventry Electric Railway. In a humorous and at the same time complete manner this plant is fully described and illustrated. *Lightning* (London), Nov. 21, '95.

Overhead Feeder and Trolley Construction of the New Orleans Traction Company. By Nelson W. Smith, M. E. A series of articles contributed to *Elec. Railway Gazette*, Nov. 23, '95.

The New Storage Battery Cars on the Madison Avenue Line of New York. Detailed description, including various plans and diagrams of trucks, switchboards, transfer truck, etc. See also Storage Battery. *Elec. Engineer*, Nov. 27, '95.

Street Railway Repair Shops. By H. P. Merriam. The recently completed and expensive repair shops of the electric traction divi-

sion of the Union Traction Company of Philadelphia are illustrated and described in *Street Railway Journal*, Dec., '95.

Electric Tramway of Hutin and Leblanc. An alternating current system described in *L'Eclairage Electrique*, Nov. 16, '95.

Electric Locomotives. By Edgar Worthington. Paper read before the Manchester Assoc. of Engineers, Nov. 23, '95. A very exhaustive article, too large to be abstracted. Just a few points are mentioned.

The electric railways constructed by European engineers now number 81, with a total length of about 440 miles. Those in Europe are distributed as follows :—

Germany	22	electric railways.
England	13	"
France	11	"
Switzerland	8	"
Italy	4	"
Austria	4	"
Belgium	3	"
Spain	1	"
Norway	1	"
Roumania	1	"
Russia	1	"
Servia	1	"

The requirements of electric motors for railway purposes may be summarized as follows :—

1. Lightness.
2. Must be completely closed from dirt, water, etc.
3. The capacity should be ample to enable it to perform its nominal duty for two hours continuously without heating above 50° C. (122° Fah.).
4. The motor should be capable of developing on emergency 50 per cent. more than its rated capacity.
5. All parts should be accessible and easily taken apart.

—*Practical Engineer*, Nov. 29, '95, and three subsequent issues.

Power Station Records of the Montreal Street Railway Company. Contains a complete table, giving power station records of the company for a period of twelve months. *Street Railway Journal*, Dec., '95.

Proposed Electrical Construction of the Metropolitan Street Railway Company, New York. Describes the standard conduit construction adopted for all future extensions of this company, with the important improvements made over the Lenox Avenue form. Illustrated by working drawings of yoke, insulator and plow. *Street Railway Journal*, Dec. '95.

Electrical Road Carriages. By Walter G. Bersey. Picturing some possibilities. London *Lightning*, Dec. 12, '95.

Track and Overhead Department Economics. By J. W. Greer. A plea for more careful and intelligent workmanship in laying light track, rather than the adoption of high, heavy rails. *St. R'y Review*, Dec. 15, 95.

Power Plant of the Nassau Electric Railway. Some remarks on the installation. *Elec. R'y Gazette*, Dec. 28, '95.

STORAGE BATTERIES.

The Manufacture of the Chloride Accumulator. After a short description of the history of the Electric Storage Battery Co., we find the successive steps of the manufacturing explained with splendid illustrations of the "Casting the Chloride Pastilles," "Casting and Plate Finishing Department," "Forming Room," "Dynamo Room," "Casting Lead Frames under Pressure, Cutting up Asbestos Cloth, Reducing Room, Charging Switchboard, etc." *Elec. Engineer*, Dec. 19, '94.

The Commercial Possibilities of Accumulators for Tramcar Traction Considered as a Municipal Undertaking. By Alfred H. Gibbings. A paper read before the Northern Society of Electrical Engineers, Manchester, Eng., Dec. 10, 1894. This paper shows that a system of this sort may well be employed by a municipality which has other interests besides this one to guard and gain power, for example, by burning power refuse, transform this and utilize it for the charging. *Electricity*, Dec. 19; *St. R'y Gazette*, Dec. 29, '94, and Jan. 5, '95.

The Storage Battery in Telegraph Offices. By Wm. Fume. The first of a series of articles gives in the introduction a description of the principles involved in the storage battery. *Telegraph Age*, Jan. 1, '95.

Storage Batteries. By J. Appleton. A short article in which the writer explains the principles underlying the storage battery actions and in which he gives a description of the most modern and most important batteries. *Elec. World*, Jan. 5, '95.

Local Action in Accumulators. By G. Darriens. Translated from an article in *L'Électricien*. The writer shows that the local actions in the secondary couples are manifold, and that they are inherent to the physical structure of the electrodes. *London Elec. Review*, Jan. 11, '95.

Some Characteristics and Economics of Accumulators as Applied to Central Lighting and Power Stations. By John R. Markle. Paper read before the Northwestern Elec. Assoc., Jan. 16, '95. The writer enumerates and considers in detail the following three functions, which he claims the storage battery can fulfill: First, storage or holders of potential; second, equalization or controlling pressures; third, transforming or transmitting electromotive force and current. *Western Electrician*, Feb. 2, '95; *Elec. Review*, Feb. 6, '95.

Contribution to the Study of Accumulators. By G. Darriews. A short popular treatment. *L'Electricien*, Feb. 9, '95.

Storage Batteries Charged by Gravity Cells. Mr. E. C. Drews, of The Dalles, Oregon, describes in the *Scientific American* a method

he uses of charging storage batteries by gravity batteries. He says: "I have three storage batteries, composed of five plates each. I use six Crowfoot batteries for charging. The Crowfoot batteries are connected three in series and two in multiple arc. The storage batteries are connected in series, and each battery is connected on a binding screw of a three-point pole charging switch with the three crowfoot cells. The switch is moved one point every 12 hours, so that each battery gets its supply of current. These batteries have been in use for a year and a half, and I have not had any trouble with them, excepting when the crowfoot cells had to be renewed. I am at present using two lamps of two candle power, and the longest time that I have used them at one time was three hours." *Elec. Review*, Feb. 20, '95.

Storage Battery Plant for Electric Light and Railway Work at Merrill, Wis. Description of plant, with an especially interesting diagram showing the switchboard connections. *Elec. Review*, March 6, '95.

Accumulator Battery for Telegraphic Purposes. Directions for installation and maintenance. By Harry Hofmeister, Imperial German Telegraph Director, Germany. *Elec. Review*, May 22, '95. Continued in subsequent issues.

Uses of Commutators. By J. C. Howell. Read before the Northern Soc. of Elec. Eng's. Writer reviews the work of the early experimental stage, and gradually leads us to the work of the present time. He then points out by various calculations that the storage battery is an important element in the economic management of any station. *London Elec. Engineer*, May 24, '95.

Telegraph Line Construction. By C. A. Parker. Paper read at the convention of the Association of Railway Telegraph Superintendents, Montreal, June 12, '95. Writer cautions against improper locations of pole lines. *Elec. Age*, June 22, '95.

The Electrical Accumulator. By J. B. Stewart. Paper read at the convention of the Association of Railway Telegraph Superintendents, Montreal, June 12, '95. Description of the installation of the New York terminal of the West Shore road. *Elec. Age*, June 22, '95.

Remedies for Disturbing or Interfering Currents on Telegraph and Telephone Circuits. By Thomas D. Lockwood. Paper read at the convention of the Association of Railway Telegraph Superintendents, Montreal, June 12, '95. Author discusses principally leakage and remedies. *Elec. Age*, June 29, '95.

Storage Batteries for Telegraph Work. By Maurice Barnett. As an economical substitute for primary batteries in telegraph, police, fire alarm, railway signal, etc., storage batteries are coming more and more to the front and are threatening to displace primary batteries wherever a charging current is available. A table showing that 2,392 secondary cells were capable of performing the work of 13,007 primary cells is also given. *Western Electrician*, July 20, '95.

New Investigations Concerning Accumulators. By Dr. E. Sieg. Author made an investigation of how well a storage battery will stand sudden overloading. He found that batteries may be driven until they have discharged two-thirds of their capacity, but not after that. *Elektrotech. Anzeiger*, July 25, '95.

Storage Batteries in Telegraph Work. An article written to show the advantages to be derived by using the accumulator in telegraph work. Incidentally a number of storage battery installations are diagrammatically represented. *Elec. Engineer*, Aug. 14, '95.

The New Storage Battery Plant of the Boston Edison Company. By W. S. Key. Description of the installation in *Elec. Engineer*, Sept. 18, '95.

Storage Batteries. By H. A. Earle. Paper read before the British Assoc., Sept. 17, '95. Author traces the history, thus showing the various steps in the advance up to the present time. *Electricity*, Oct. 3, '95 ; *London Elec. Engineer*, Sept. 20, '95.

Modern Uses of the Storage Battery. By Max Loewenthal. The application of the battery in sport. ELECTRIC POWER, October, '95.

Storage Battery as an Auxiliary to Street Railway Service. Methods of throwing storage battery into circuit at grades or in case of accident to the power house. *Elektrotechn. Anzeiger*, Nov. 3, '95.

Madison Avenue Storage Battery Equipment. Description of the new trucks, controller positions details of contact in *Elec. World*, Nov. 3, '95.

Storage Batteries in Office Buildings. By Charles Blizard. On the advisability of using storage batteries in conjunction with private plants. *Elec. Engineer*, Nov. 6, '95.

Storage Battery Applications. A topical discussion, held at the Amer. Inst. of Elec. Engineers, and principally participated in by Mr. A. E. Childs, who spoke in favor of the battery ; by Prof. F. B. Crocker, Ph. D., who clearly defined advantages as well as disadvantages to which storage batteries are subject ; by Mr. Nelson W. Perry, who manifestly opposed the storage battery and advocated the gas engine ; by Mr. Edgar, of Boston, who presented valuable facts derived from his experience with the battery during the last few years ; Mr. Carl Hering devoted his intention, in part at least, to the storage battery problem in railway work. *Transactions* Am. Inst. of Elec. Engineers, Dec., '95 ; *Elec. World*, Nov. 30, '95 ; *Western Electrician*, Nov. 30, '95 ; *Elec. Engineer*, Nov. 27, '95 ; *Elec. Review*, Nov. 27, '95 ; *Electricity*, Nov. 27, '95.

Use of Storage Batteries as Resistance. By Albert Nodon. A suggestion to use accumulators in central stations to replace rheostats necessary for regulation. *L'Electricien*, Nov. 30, '95.

Tommassi Accumulator and its Application in the Propulsion of Vehicles. Explanation of the system of construction of batteries. *Elektrotechn. Anzeiger*, Dec. 5, '95.

Storage Battery Manipulation at the Boston Edison Station. A short description in *Elec. World*, Dec. 14, '95.

Charging Storage Cells for Signalling Purposes. By A. S. Hubbard. A device by means of which different sets of cells are cut in or out of circuit automatically. *Elec. Engineer*, Dec. 18, 95.

Storage Battery Traction. By J. Sarcia. Author brings forward an idea advanced by Mr. Frank J. Sprague, that on storage battery cars it is advisable to use a shunt motor and reduce car speed by strengthening the magnetic field. Translated from *L'Industrie Electrique*, in *Elec. R'y Gazette*, Dec. 28, '95.

TELEGRAPHY, TELEPHONY, ETC.

Electrical Controller for Roundsmen. By Emile Dieudonné. A complete description with clear diagrams of the methods of construction and working of these instruments. *L'Électricien*, Dec. 1, '94.

The English Telegraphs. By J. B. Taltavall. 1. Metropolitan service; 2. Registration; 3. Wheatstone system; 4. Batteries; 5 Cable room; 6. Telephone; 7. Pneumatic tubes; 8. Service; 9. Telegraph equipments; 10. Operators. *Telegraph Age*, Dec. 1, '94.

Telegraphing Without Wires. By Erick Rathenau, in *Elektrotechn. Zeitschrift.* A carefully conducted experiment in the Wannsee, near Potsdam, showed once more the possibility of telegraphing without wires, and the writer recommends the following points: 1. Great current strength in the primary circuit; 2. Increasing the distance between the primary electrodes; 3. Increasing the distance between the receiving electrodes; 4. Replacing the metallic diaphragm of the telephone receiver by a light tongue; 5. This should be tuned to respond to a definite rate of vibration. *Elec. Review*, Dec. 5, '94.

The Carbonelle Microphone. Telephony without induction coils. A description of the same; a historical review of other similar instruments, and the advantages of the present one. *L'Industrie Electrique*, Dec. 10, '94.

The Telephone Door; A Study of Telephone Traffic in Exchanges and for Individuals. By Angus S. Hibbard in *Electrical Engineering*, Dec. After giving several statistics "load Diagrams," if that term is permissible for telephone work, the writer gives some practical suggestions to the subscribers as to the handling of their business over the telephone. *Elec. Review*, Dec. 12, '94.

The Signal Corps of the United States Army; Instruction Work at Fort Riley, Kan. By George Heli Guy. The duties of the corps; its course of instruction; methods of signaling; method of erecting a telegraph line, etc. With illustrations of balloon wagon, outpost cable cart and telephone kite, signal balloon, erecting field telegraph line and field telegraph train. *Elec. Engineer*, Dec. 12, '94.

Experiments in Cable Signaling. By Patrick B. Delany. A number of experiments and tests giving different speeds and different conditions. *Elec. Engineer*, Dec. 19, '94.

Origin of Telegraphing Through Water Without Wires. A letter written by Victor M. Berthold, Cambridge, Mass., contains an historical review of the experiments made on telegraphing without wires. *Elec. Review*, Dec. 19, '94.

Telephone System. The firm Rudolph Krüger in Berlin has a new arrangement by which the call-bell and induction coil are combined. Economy and the advantage that a subscriber can be called even if he has forgotten to hang up the telephone are the principal advantages to be derived therefrom. *Elektr. Zeitschr.*, Dec. 20, '94.

The Theatrophone. By Albert Marimer. An instrument which may be connected between private houses and theatres, music halls, and so forth, allowing one to listen through a telephone to the various performances. It is the original invention of Marinovitch & Szarvady (1882), and has since been constantly improved upon. A full description of the switchboard, line, etc., is given and illustrated. *Revue Industrielle*, Dec. 22, '94.

Electric Telegraphs, American-English-Scotch. By C. C. Haskins. A review of the early days of telegraphy. ELECTRIC POWER, Jan., '95.

Motor Generators for Telegraph Purposes. The Montreal office of the Great Northern Telegraph Company is about to have a dynamo plant to displace over 4,000 gravity cells. The plant will consist of thirteen machines, giving 6, 20, 80, 160 and 390 volts, respectively. *Can. Elec. News*, Jan., '95.

Progress of the Electric Telegraph. The following short table may be of some interest; it represents the number of telegraph messages sent during the year '92 in various countries.

The United Kingdom	69,908,600.
The United States	62,387,298.
Germany	31,175,100.
Austria	10,835,302.
Italy	8,322,925.
Norway	1,649,544.

This, with some additional statistics, appeared in *London Elec. Engineer*, Jan. 4, '95. A very similar table, which, however, does not agree in every respect with the above, appeared in *Elektrotech. Zeitschrift*, Jan. 17, '95.

The Telautograph. By Nelson W. Perry, E. M. In the series of articles on "Popular Electrical Science" this instrument is described, with suggestions for its use. *Electricity*, Jan. 9, '95.

Long Distance Telephony. By F. W. Dunbar. After a description of the action of a Bell telephone the writer explains the battery transmitter, which is also illustrated. He then describes and illustrates the long distance telephone circuit, and finally treats simultaneous telegraphy and telephony. *Elec. World*, Jan. 12, '95.

How and Where Messages are Flashed Under the Ocean. An illustrated article of some of the principal cable stations. *Telegraph Age*, Jan. 16, '95.

Transmitting, Recording and Seeing Pictures by Electricity. By Geo. R. Carey. The description and illustrations of the writer's inventions. *Elec. Engineer*, Jan. 16, '95.

The Telephone. By Nelson W. Perry, E. M. Popular treatment:—An explanation of its modus operandi; the musical and

speaking telephones, and their essential differences described. *Electricity*, Jan. 16, '95.

Peculiar Telephone Troubles Caused by Alternating Current Distribution. By E. W. Mix. From the *London Electrician*. After explaining a number of troubles and investigating the same, the writer came to the following conclusion: "Electrostatic induction is quite as, if not more, capable of creating telephonic disturbances as electromagnetic induction with high frequencies and potentials, and precautions should be taken to keep the two conductors near together, so that one may neutralize the other. In electrostatic induction the earth and even buildings, serving as an intermediary conductor of large capacity, tend to increase the area of influence of electric charges received by the primary wires." *Electricity*, Jan. 16, '95.

Experiments in Cable Signaling. By Patrick B. Delany. A number of experiments actually performed, by means of which the writer wished to demonstrate the great superiority of machine working over hand transmission. *London Electrician* and *Electricity*, Jan. 16, '95.

The Making and Laying of Underground Cables. By Wm. Maver, Jr. A brief account of the main processes of manufacture and construction of some of the more prominent types of cables and subways now in use. The principal headings are: Wire drawing, Wire turning, Wire stranding, Insulating the wire, Taping machine, Vulcanizing, Measuring machine, Lead covering, Laying underground cable. The article is illustrated. *Elec. World*, Jan. 19. '95.

The Magneto-Telephone. By Nelson W. Perry, E. M. Plain directions how to construct at small expense a most serviceable instrument for the residence or office. *Electricity*, Jan. 23, '95.

The Origin and Development of the Telephone Switchboard. By J. E. Kingsbury. A paper read before the Institution of Elec. Eng's, Jan. 25, '95. *London Elec. Engineer*, Jan. 25, '95.

The Mexican Central Railway Telegraph System. By George Heli Guy. The Mexican Central Railway threw its telegraph lines open to the public in 1880. Besides building up a collateral source of revenue for themselves, the company conferred quite a benefit on the public at large, for the Government telegraph was badly mismanaged. *Elec. Engineer*, Jan. 30, '95.

The Telautograph of Elisha Gray. By M. J. Voisenat. One of the most complete descriptions ever published explaining in detail the theory, the machinery and practical working. *Bull. de la Soc. Intern. des Electr.*, Feb., '95.

Technical Telegraphy Papers. By Jas. Bell and S. Wilson. The first of a series of articles, dealing with submarine telegraphy. *London Electricity*, Feb. 1, '95.

The Origin and Development of the Telephone Switchboard. By J. E. Kingsbury. Read before the Inst. of Elec. Eng's, Jan. 24, '95. Mr. Kingsbury traces the whole history of the simple switchboard,

to the stage in which it is supplied with an indicator and a spring-jack for each line, with pairs of plugs and connecting cords in whose circuit are placed convenient keys, whereby the calling generator and the operator's speaking instruments can be quickly brought into circuit with either subscriber's line. *London Elec. Review*, Feb. 1, '95.

The Microphone or Battery Telephone Transmitter. By Nelson W. Perry. Number X of the Popular Electrical Science Series. *Electricity*, Feb 6, '95.

Telephone Communications with Bare Wires Stretched on the Ground. For some time past, the idea prevailed that certain bi-metallic wires could be stretched without insulation on the ground and allow good telephonic transmission. The German Government has lately undertaken a long series of tests, the result of which was that these compound wires have no advantage over ordinary copper wire, and that the strength and weight under otherwise similar conditions has the deciding influence on the distance to which a conversation through bare wires may be kept up. *Elektr. Zeitschrift*, Feb. 7, '95.

A Model Telegraph Office. Description of the Omaha Western Union office. The messenger force consists of 24 boys, 15 of whom possess bicycles. *Telegraph Age*, Feb. 16, '95.

Telephonic Cables with Dry Air Circulation. By A. Barbaret, in "Annales Télégraphiques." Description of the air insulated cables in Paris with a number of numerical results obtained by experiments. *Elec. Review*, Feb. 20, '95.

Portable Telephone Apparatus for the Use of Telegraph and Signal Lines. Illustrations with description of apparatus appeared in *Elektrotechnischer Anzeiger*, Feb. 21, '95.

Phonographic Lecturer's Table.—The stenographer and engineer, Beyerlen, of Stuttgart, Germany, is at present constructing a phonographic lecturer's table, to take lectures. He hopes to be allowed to experiment shortly in the Reichstag. *Elektrotechnischer Anzeiger.*

Motor Generators for Telegraph Purposes. The Great North-Western Telegraph Company has completed arrangements for the installation of a dynamo plant in their Montreal office. It is to be of the type known as the motor generator, and when completed will displace over four thousand cells of gravity battery. The plant will consist of thirteen machines. The generator side will give the following voltages: 6, 20, 80, 160 and 330 volts respectively. The 6 and 20 volts are used for local work and short lines; the 80 and 160 volts for ordinary lines, and the 330 volts for quadruplex work. Each group consists of two machines of opposite potentials, with a spare machine to be used as a "relief." The adoption of dynamo currents will effect a great saving in space and materially increase the efficient working of the company's lines. The machines are being built by the Toronto Electric Light Company. *London Electricity*, March 1, '95.

Note on Telephony in the United States. By G. de la Touanne. Description of the Law system, with diagrams of connections. *L'Eclairage Electrique*, March 9, '95, and continued in subsequent issues.

Investigations on the Induction in Cables. By Dr. F. Breisig. A mathematical treatment. *Elektrotechn. Zeitschrift*, March 14, '95.

Self-Winding Clocks and their Operations. By A. C. Terry. The first of a series of articles, illustrated diagrammatically. *Telegraph Age*, March 16, '95.

Signalling Weather Predictions by Search Light. The use of the electric search light to signal approaching changes of weather over wide areas in populous districts is likely to become a distinctive feature. The first installation in Chicago is described in *Western Electrician*, March 16, '95.

American Bell Telephone Company's Annual Report. Full text of the report of the business for the year ending December 31, 94. See *The Electrical Review*, April 3, '95.

The Amstutz Electric Artograph. It may be claimed now, though we do not see an object miles distant through the wire, yet this same inanimate wire and electrical current will soon serve us, automatically as both artist and engraver, transmitting and engraving at the same time a copy of a photograph miles away from the original. *Scientific Am.*, April 6, '95.

The Perrin, Bonta and Cole Telephone Patents. A complete and well illustrated description of these patents. *Elec. World*, April 13, '95.

How Cables are Repaired. A well illustrated description on this subject is given in *Telegraph Age*, April 16, and is to be continued in subsequent issues.

Long-Distance Microphone Transmitters. Editorial *Elec. Engineer*, April 17, '95.

Municipal Telephones. In England the press certainly believes in municipal enterprises to judge from the following remarks:

Municipalities are better qualified to take up the question of telephony than any other authorities. The possibilities are all on the side of the public gaining considerably if, instead of licensing an individual trust to do all the public telephonic work in the country, the responsibility were thrown upon local authorities. The streets are controlled by these bodies, which in regard to telephones is a primary advantage to the public, and one which in itself would not only simplify matters but would mean a considerable saving of expense. That they could be managed and maintained satisfactorily is guaranteed by our system of representative government, and by the fact that in all the great centres, and in many of the smaller ones, there are chambers of commerce or other like bodies who are powerful enough as representatives of the commercial and trading classes—those most affected in this question—to ensure a fair hear-

ing by the local authorities for the desires and recommendations expressed or adopted by their members. In this way local influences and local enthusiasm would come into play, and interest would be stimulated in the welfare of systems which would be altogether wanting if the service rested in the hands of a great trading company. This appeared in *Lightning*, April 18, '95.

A Semaphore Telegraph Station. Description with illustration of a station in France. *Scientific American Supplement*, April 20. '95.

Early History of Telephony. The text of the reply of Prof. D. E. Hughes, F. R. S. to the toast of "Our Guests," at a banquet given by the staff of the National Telephone Company, London, March 15, '95, is practically a review of the part that Hughes himself played in the development of the transmitter. *Scientific American*, April 20, '95.

Submarine Telegraph Cables. Lecture delivered before the Kearsage Association of Naval Veterans of Boston, Feb. 14, '95. By Samuel Trott. *Elec. Engineer*, April 24, '65.

Automatic Telephone Exchange. By Victor M. Berthold. A description of an exchange, constructed by Deckert and Homolka of Prague, and in operation since 1887. *Elec. Review*, April 24, '95.

Microphone for Great Distances. By W. Jacques. Description taken from *Elec. Engineer*, Vol. XIX., No. 360. See *Elektrotechn. Anzeiger*, May 2, '95.

Practical Telephony. By Jas. Bell and S. Wilson. Description of the theory of the Bell telephone. *London Electricity*, May 3, '95. Continued in subsequent issues.

The Genesis of the American Electric Telegraph. By Franklin Leonard Pope. A review, with portraits of Morse and Vail. *Elec. Engineer*, May 15, '95.

Control Signals. By A. Prasch. Author refers to different methods of control and tries principally to show how to place the batteries. *Elektrotechn. Zeitschrift*, May 16, '95.

Telephone and its Operation. By Morgan Brooks. Illustrations showing central office views, switchboards and diagrams of different types of telephone receivers and transmitters. *Cassier's Magazine*, May, '95.

Telegraphy as it Used To Be. By G'r Lodian. With nine illustrations of ancient methods of signalling, and portraits of Chappe and Morse, the inventors of the aerial and electric telegraph, respectively. *Cassier's Magazine*, May, '95.

Investigations on the Current Flow in Cables when worked by a Hughes Apparatus. By F. Breisig and B. Bockelmann. A report of the bureau of Telegraph Engineers. *Elektrotechn. Zeitschrift*, May 23, '95.

Mexican Government Telegraph Service. The zone system of rates. By Geo. Heli Guy. Statistics show that the wires of the Federal service at the present time run a length of 26,016 miles;

number of poles in existing lines is 628,020; number of pounds of wire, 8,373,000; number of offices open for service, 306. *Elec. Engineer*, May 29, '95.

Telephone Stations in Germany. In the beginning of October '94, there were telephone connections in 388 different places in Germany with 87,181 connections and 138,694 km. conductors. The number of calls per day was 1,041,581. In the largest places these were divided as follows:

	Subscribers.	Daily Calls.
Berlin	22,069	223,211
Hamburg	8,995	153,903
Dresden	3,267	57,689
Leipzig	3,290	95,812
Frankfurt on Main	2,674	

Elektrotechn. Zeitschrift, May, 30, '95.

Telephone in Stuttgart, Germany. By Jul. H. West. A complete description of the entire telephone system in that city. *Elektrotechn. Zeitschrift*, June 6, '95.

Reis's Place in Telephony. By A. E. Dolbear. Writer points out that Reis was the true inventor of the telephone, that he would have had a perfect one, had he substituted carbon for platinum; he points out furthermore that Hughes made that substitution. *Elec. Engineer*, June 19, '95.

The Quadruplex Telegraph in America. By Jul. H. West. Lecture delivered before the Electrotechn. Verein in Berlin, April 23, '95. Author describes the development of the system, and shows by means of diagrams the complete arrangements of the station instruments as a whole, and describes each instrument separately. *Elektrotechn. Zeitschrift*, June 27, '95.

Burry Stock and News Printing Telegraph. As time intervals between "printing impulses" are subject to great variations in practice, it sometimes happens that the main spring may run down or may be overwound. Also, difficulties have been encountered in the gearing between weights and escapement controlling the type wheel of the ticker. These difficulties are overcome in the instrument described in *Elec. Engineer*, July 31, '95.

The Invention of the Electro-Magnetic Telegraph. By Francis W. Jones. The first of a series of articles in which the writer again attempts to establish who the true inventor of the telegraph was. *Elec. World*, July 20, '95.

This article is continued, and then follows a paper on the same subject by Mr. Franklin L. Pope in the issue of Aug. 10, '95.

Sending Pictures by Telegraph. A method devised by Mr. W. H. Lowd is demonstrated in *Elec. Review*, Aug. 21, '95.

The Invention of the Electro-Magnetic Telegraph. By J. J. Fahie. A contribution on the Henry Vail controversy. *Elec. World.* Aug. 24, '95; continued Aug. 31, '95.

A Telephone System. By John Absterdam. Description of a system with a permanently open circuit. *Elektrotechn. Anzeiger*, June 27, '95.

Telephony. By Dr. v. Wietlisbach, of Bern, Switzerland. The following are the subject heads: Long-distance telephony; theory of induction; free metallic circuits; repeating coil; theory of same. *Elec. Engineering*, August, '95, and continued in subsequent issues.

Telegraph and Telephone Systems of the World. A set of very interesting statistics comparing the various countries. *Elektrotechn. Anzeiger*, Aug. 25, '95.

American Bell and Western Union Agreement of 1879. First and full publication of the exact text of the famous compact of 1879. *Elec. Engineer*, Aug. 28, '95.

Daily Insulation Testing of Telegraph Lines. By W. H. Preece, F.R.S. Paper read before the Inst. of Elec. Engineers. Author describes the system in use in England. *Elec. Review*, August 28, '95.

Growth of the Long-Distance Commercial Telephony. An interesting article showing how the use of the telephone has been steadily increasing, and throwing out some hints as to the districts which want more perfect networks. Some statistics relate to the contract between the Western Union and Bell Telephone Companies. *Elec. Engineer*, Aug. 28, '95.

Developments of Telephone Service in Agricultural Districts. By Major-General Webber, C.B., R.E. Paper read before the British Assoc., Sept. 16, '95. Author brings a number of statistics by which he tries to prove the advisability of establishing telephone service in rural districts. *London Elec. Review*, Sept. 27, '95.

Some Lessons in Telephony. By A. R. Bennett, M.I.E.E. Paper read before the British Assoc., Sept. 16, '95.

It has recently been demonstrated that the United Kingdom is deficient in railways in their branch or feeder form, and telephones, which are the natural feeders of the telegraphs. Why this is so may best be discovered by ascertaining by what means, technical or economical, those nations which have most conspicuously outstripped us have attained their superiority. For the purposes of this paper, in which is considered the telephonic branch of the question, the countries of Europe have been divided into three groups: (1) well telephoned; (2) indifferently telephoned; (3) badly telephoned.

A country may most properly be said to be well telephoned when its smaller towns and villages enjoy facilities, for the existence of a few large exchanges in the capital and chief towns does not entitle it to that distinction. For instance, France, Russia, and Portugal all possess good exchanges in their capitals, but are nevertheless badly telephoned as a whole, since their smaller towns and villages are excluded from the circle.

The table on following page shows in concise form the state of telephone distribution on the European continent.

Country.	Population.	No. of exchange telephones	No. of persons to each exchange telephone	Characteristics of management.
Group I.				
Norway.....	2,000,917	13,943	144	Very low rates. Local management of exchanges. Good rural intercourse. No competition.
Sweden.....	4,784,981	32,602	147	Very low rates. Local management of exchanges in part. Good rural intercourse. competition
Luxemburg.....	211,088	1,315	160	Very low rates. Central management, but with delegated control in some cases to local authorities Good rural intercourse. No competition.
Switzerland	3,000,000	17,422	172	Ditto Ditto Ditto.
Denmark	2,185,335	10,325	211	Very low rates. Local management of exchanges. Good rural intercourse. No competition.
Finland.....	2,412,135	7,351	328	Very low rates. Local management of exchanges. Good rural intercourse. Competition.
Group II.				
Imper. German P. O. Territory.	41,796,966	93,131	449	Fair rates for urban subscribers in large towns; high rates in small towns. Highly centralized management. Bad rural intercourse. No competition.
Bavaria	5,594,982	12,400	451	Ditto Ditto Ditto.
Wurtemberg ..	2,036,522	4,430	459	Low rates for urban subscribers, but with regulations tending to restrict suburban and rural intercourse. Centralized management. No competition.
United Kingdom.....	37,880,764	59,569	636	High rates, with regulations unfavorable to development outside towns. Local management in part. Practically no competition.
Holland.....	4,669,576	7,263	643	High rates in three chief towns; low rates elsewhere. Management chiefly centralized. Bad rural intercourse. No competition.
Belgium.....	6,136,444	8,757	700	High rates in large towns; low rates of recent origin in small towns. Centralized management. Indifferent rural intercourse. No competition.
Group III.				
France.....	38,343,192	26,772	1,432	High rates; subscribers also pay capital cost of their installations, except in Paris and Lyons. Centralized management. Bad rural intercourse. No competition.
Spain.....	17,800,000	10,984	1,618	High rates in large towns. Recently introduced reduced tariff for smaller towns. Local management. Bad rural intercourse. No competition.
Austria.....	23,895,413	14,574	1,640	Fair rates, but subscribers pay capital cost of their installations. Centralized management. Bad rural intercourse. No competition.
Italy	30,535,848	12,067	2,530	High rates in large towns, except in Rome, where competition exists; low rates in Rome and in small towns, but under strict Government supervision. Bad rural intercourse. No competition except in Rome.
Hungary.....	17,463,473	5,563	3,139	High rates in towns; very low rates in villages, but combined with regulations which tend to restrict communication between towns, suburbs and villages. Partly local management. No competition.
Portugal	5,000,000	1,483	3,371	Exchanges only in Lisbon and Oporto. Fair rates. No rural intercourse. No competition.
Russia.....	97,151,789	7,415	13,102	Highest rates in Europe in chief towns; high rates in smaller towns. Partly local management under Government rules. Bad rural intercourse. No competition.

—*London Elec. Review*, Sept. 27, '95.

"Token" Telephone System. Illustrated description of the Gray Automatic Pay Station used with the "Token" system. *Elec. Review*, Oct. 2, '95.

Long-Distance Telephony. By Claudio Baradat. Author compares the problem with the transmission of power through long distances; he treats what he calls a multiple induction system. Various diagrams show methods of connections. *L'Eclairage Electrique*, Oct. 5, '95.

Pupin Multiple Telegraph. Description of system with diagrams of connections. *L'Eclairage Electrique*, Oct. 19, '95.

Invention of the Electromagnetic Telegraph. By Mary A. Henry. Continuation of the work long ago started by the daughter of the great philosopher. *Elec. World*, Nov., '95.

Transportable Miniature Telephone Stations. Description of a new patented instrument which is principally intended for private house service. Judging from the illustrations, it seems to be a very ingenious device. *Elektrotechn. Anzeiger*, Nov. 3, '95.

A Fac-simile Telegraphy. By Dr. L. Cerebotani, Munich, Germany. The first of a series on the subject, Mentions summarily the principles involved in the telautograph, writing or pantelegraph, etc. *Elektrizität*, Nov. 9, '95.

Municipal Telephony. By A. R. Bennett. Paper read before the Northern (British) Soc. of Elec. Engineers. Author gives his experiences in investigating municipal plants in Norway and other places on the continent. *Elec. Review*, Nov. 27. '95; *London Elec. Engineer*, Nov. 15, '95.

The Boughton Telephotos for Long-Distance Visual Signalling. Description of apparatus to communicate at night by means of incandescent lamps. *Elec. Engineer*, Nov. 20, '95.

Skeen Automatic Semaphore Signal for Electric Railway Crossings. A method which is applicable for day and night use; can also be used as block system on single track roads. *Elec. Engineer*, Nov. 27, '95.

A Laboratory Telephone. By E. W. Caldwell. Occasionally it is desirable to change the winding of a telephone, and to keep the same magnet and diaphragm and exactly the same adjustment of the distance between the diaphragm and magnet. To meet such a condition, the writer has devised a special form of magneto-telephone, described and illustrated in *Elec. Review*, Nov. 27, '95.

Municipal Synchronous Clocks. By F. Hope-Jones and G. B. Bowell. Suggestions of simple methods for keeping time. *London Lightning*, Nov. 28, '95.

New House of the Postal Company at Chicago. By E. J. Nally. A very voluminous but extremely careful description with many illustrations. *Western Electrician*, Dec. 14, '95.

Experimental Use of the Essick Page Printing Telegraph for transmitting information in sea-coast artillery firing, 1895. Abstract

from the *Journal of the U. S. Artillery*. By H. C. Carbaugh, First Lieut. Fifth Artillery, U. S. A. The Essick instrument, by the aid of electricity to control its machinery, print messages on a sheet of paper five inches wide, and is operated in a manner similar to a typewriter, so that the operator always has before him, in ordinary printed figures and alphabetical characters, an exact duplicate of what is being received at the several stations along the line. The working of the transmitter and receiver is carefully described in *Elec. Engineer*, Dec. 18, '95.

The Cable Repair Steamer Mackay Bennett. Illustrated description appeared in *Scientific American*, Dec. 28, '95.

TRANSMISSION AND POWER.

Electricity as a Motive Power. By D. Selby-Bigge. See Synopsis of November, also *Elec. Engineering*, Dec., '94.

Power Transmission System at the King Powder Mills. A direct current power plant. *Elec. Industries*, Dec., '94.

The Application of Electricity to Elevator Service. By Geo. Edw. Harding. Read before the American Institute of Architects. A review of the principal plants installed, with special reference to the Postal Telegraph Building. *Pacific Electrician*, Dec., '94.

Relative Cost of Electric Power and Wire Rope Haulage. Mr. J. T. Forgie in a paper read before the Mining Institute, of Scotland, on the electric power at the Dumbeck Colliery, electric power was advocated. Mr. Henry Rowan, of Crosstries, took exception to his statements, and comparative tables of installations and running expenditures are given. *Am. Man. and Iron World*, Dec. 7, '94.

Some Notes on Multiphase Power Transmission. By Ralph D. Mershon. A comparison between the efficiency of two and three phase systems, and different methods of connecting two transformers for transforming from two to three phase, form the gist of the paper. *Elec. World*, Dec. 15, '94.

Lighting and Power Transmission by Means of Diphase Generators. M. P. Boucherot presented a paper before the Soc. Internat. des Electriciens, outlining the reasons for adopting the diphase system. 1. Higher efficiency than simple alternation; 2. Motors are more easily started, and 3. The system is better adapted for power and light distribution. It has been adopted in the works of Weigher & Richemond at Pantin. Abstract in *London Elec. Engineer*, Dec. 21, '94.

Niagara Power is the heading of a short article giving the dimensions of the principal machinery put in at Niagara for the generation of electric power. *Age of Steel*, Dec. 22, '94.

Electrical Transmission at Niagara Falls. By Horatio A Foster. An interesting article showing the gradual development and final engineering work of the electrical transmission plant. ELECTRIC POWER, Jan., '95.

Large Electrical Transmission Plant. The King Powder Co., of Kings Mill, O., have changed their water power plants into an electrical transmission plant. They develop between 700 and 1100 horse-power. The farthest motor is situated 3,000 feet from the power house, and the loss on this motor is just 10 per cent. A detailed description with the views of the machinery and power house is given in *Power*, Jan., '95.

Possible Improvements in the Supply of Electrical Energy. By S. Z. de Ferranti. The writer after some introductory remarks says: "As regards the distribution of electrical energy, we are therefore brought face to face with the fact that the only system which can completely meet conditions absolutely necessary to eventual success is the alternating high tension one. But of course this system, as is well known, leaves much to be desired in certain directions." He points out various improvements, such as superheating of steam, improving the load factor of stations, etc. *London Elec. Review*, Jan. 4, '95.

Electrical Power Transmission. By Louis Bell, Ph. D. The seventh of a series of articles, treating power transmission by continuous currents. This number also contains a short synopsis of the preceding articles which have appeared on that subject during the last few weeks of the year 1894. *Elec. World*, Jan. 5, '95.

Niagara To-Day. Besides a number of illustrations, an interesting letter written by Prof. Forbes to the *London Times*, summing up the situation at Niagara Falls appeared in *Elec. Engineer*, Jan. 16, '95.

Design and Efficiency of Plant for Transmission of Power by Electricity. By W. C. Mountain. The first part of a paper in which the writer discusses some practical rules as to finding the loss in volts in a cable; loss in watts in a cable; class of cables, efficiency of motors. *London Elec. Engineer*, Jan. 18, '95; *London Industries and Iron*, Jan. 18, '95.

Electrical Transmission at Pordenone. An illustrated description of a continuous current transmission plant at Pordenone, Italy. ELECTRIC POWER, Feb., '95.

Selecting Motive Power for a New Plant. By Charles E. Emery, Ph. D. Water power and electricity considered. *Engineering Magazine*, Feb., '95.

Transmission of Power by Synchronous Alternating Current Motors. By M. R. V. Picon. A practical discussion, with views as to limitations. *Bull. de la Soc. Intern. des Electr.*, Feb., '95.

Electric Power for Isolated Factories. By Wm. A. Anthony. That power can be transmitted by electricity is perfectly well understood, what remains, is to demonstrate the advantages over other modes of transmission, to show that it will "pay." That is the problem which the writer tries to solve in the paper. *Engineering Magazine*, Feb., '95.

Electric Power in a large Newspaper Establishment. The *Philadelphia Inquirer* makes ample use of electricity for light and and power in their new building. Motors are used for the various power purposes of a newspaper establishment. Directly belted to each press is a slow speed Eddy motor. That on the largest press is a 40 horse-power machine, operated at 475 revolutions per minute, and on each of the smaller presses is a 25 horse-power motor at 525 revolutions. *Western Electrician*, Feb., 2, '95.

Electricity as the Future Motive Power in the Textile Industries. Paper read before the Manchester Assoc. of Eng's, by Mr. G. H. Firth and Mr. D. Selbe-Bigge, Jan. 26, '95. An exhaustive study which forces the writers to the conclusion of using a motor for every machine, in order to do away with the heavy frictional losses during transmission. *London Industries and Iron*, Feb. 1, '95.

The Niagara Power Transmission Plant. By Frank C. Perkins. A description of the power house, elevator and wheel pit, lubricating apparatus, switch board, foundation, 5,000 horse-power alternator, rotary transformer and transformer house. *Elec. World.* Feb. 9, '95.

The Utilization of Water Power in California. The Folsom-Sacramento transmission. By Geo. Heli Guy. Short description, with illustrations of the mechanism controlling the head gates. *Elec. Engineer*, Feb. 13, '95.

Water Power Installations for Electric Lighting. By E. R. Dolby, Wh. Sc. A short article but well to the point, in which the writer points out and quotes actual examples that it appears very undesirable to hurry into the proposal of the use of water power for comparatively small outputs without very carefully weighing the pros and cons: "The fact that water power is present without any rental to pay, appears often to blind people to the difficulties in the way of applying it." *London Elec. Engineer*, Feb. 15, '95.

Electric Motors for Operating Machine Tools and other Appliances. An abstract of a few particulars respecting some points of interest in workshop practice from a very long exhaustive report prepared by Messrs. G. Dumont, G. Baignères and A. Lencanchez upon the subject of electric energy transmission in general. The points refer to a small lathe and an overhead crane. *London Elec. Engineer*, Feb. 22, '95.

Turbines for Electric Power Plants. By Schwartze. The writer discusses the various advantages of the existing turbines, since he considers this subject of particular interest to the electrical engineer at the present time. *Elektrotechn. Anzeiger*, Feb. 24, '95.

Electricity on the Canals. By M. A. De Bovet. A thorough review of the problem. *Bulletin de la Soc. Intern. des Electr.*, March '95.

Electric Power in Southern Cotton Mills. By A. F. McKissick. A careful deduction why in many cases, and especially in the one quoted in the paper, electrical transmission is preferable to mechanical transmission. *Engineering Magazine*, March, '95.

Electric Power in Organ Blowing. Abstract of a paper read by Mr. Walter J. Fryer. Description of motor and methods of attaching the same. A 3 H. P. motor, which can be worked to 4½ H. P., is used. *London Elec. Engineer*, March 8, '95.

Electric Transmission of Power. By Alexander Siemens. The writer's principal object is to lay before the members some results of the adoption of the electric transmission of power at the Wool-

wich works of Messrs. Siemens Bros. & Co. Curves and tables help to make the description clear. *London Elec. Engineer*, March 8, '95.

The Use of Two or More Motors on Electrical Cars and Locomotives. By Mr. Paul Hoho. Speaks of the pros and cons of installing two or even more motors on the same car. *L'Eclairage Electrique*, March 2, '95.

Lubricating and Bearing-Cooling Devices in the Niagara Falls Power Plant. By Frank C. Perkins. An illustration of the oil tank, with filtering cylinders, oil pumps and pipes placed in position upon it. *Western Electrician*, March 9, '95.

Industrial Use of Motors on Power Circuits. Operated by the Street Railway Company at Los Angeles, Cal. By George Heli Guy. Descriptions and illustrations of electric toboggan slide, press room of lithographic company, electric cancelling machine, grinding paint by electricity, and knife grinding. *Elec. Engineer*, March 13, '95.

Notes on Recent Electrical Engineering Developments in France and England. By H. Ward Leonard. Referred to in April Synopsis under "Miscellaneous." See also, *St. R'y Gazette*, March 2, '95; *Elec. Engineer*, March 6, '95; *Electricity*, March 13, '95; *Elec. Review*, March 20, '95.

The Water Works of De Kalb, Ill., Operated by Electricity. The plant is operated entirely by electric motors, and is the first of the kind erected in the West. *Electrical Industries*, April, '95.

Water Powers at the Western States. By A. G. Allen. The essence of the paper, which is well illustrated, is to point out the vast field for electrical enterprise. *Engineering Magazine*, April, '95.

Water Power Applied by Electricity to Gold Dredging. By Robert Hay. Abstracted in *Electricity*, April 3, '95.

Electrical Haulage at Earnock Colliery. By Robert Robertson, B. Sc. Paper read before the Institute of Civil Engineers is given in abstract in *Electricity*, April 3, '95.

Best Combination of Plant, Mains, etc., for an Electric Light Undertaking. By R. A. Dawbarn. A paper read before the Falcon Works Engineering Society, Loughborough, Feb. 6, '95. In this issue the engines, slow speed vs. moderate speed, and condensing is discussed. The paper is to be continued in subsequent issues of *London Elec. Review*, April 5, '95.

Electrical Enterprise in California. The Los Angelos Electric Company. By Geo. Heli Guy. Description of plant, with several illustrations. *Elec. Engineer*, April 17, '95.

Some Central Station and Transmission Electrical Losses. By A. B. Herrick. Based on some notes prepared by the author for the National Electric Light Association, at Cleveland, February 19–21, '95. See *Elec. Engineer*, April 17, '95.

Distribution of Power from Niagara. By Frank C. Perkins. A clear description of the Pittsburg Reduction Company plant, with

illustrations and a review of some other companies which are supposed to take power from the Cataract Construction Company. *Western Electrician*, April 20, '95.

The First Three-Phase Plant in Canada. The station at St. Hyacinthe. The electric equipment of the power house consists of three three-phase alternators, each having a capacity of 150 K. W. at 2,500 volts. They are compound-wound. Periodicity is 60 cycles per second. Complete description appeared in *Elec. Engineer*, April 24, '94.

Electric Loading of Turbines. By Ernst Egger. Very few mechanical governors, possibly none, are capable of following as quickly as the electric load may be thrown on or off a machine. In this article is given a description of an instrument which is supposed to do that perfectly satisfactorily. *Elektrotech. Zeitschrift*, April 25, '95.

The Electric Motor in the Machine Shop. By George Richmond. Paper read before the American Society of Mechanical Engineers. "Leaving out of consideration the substitution of motors for steam engines, there remain three forms of application of the principle of special interest to the mechanical engineer, namely: 1. The driving of isolated tools where convenience is a chief consideration; 2. The grouping of a number of machines around a motor admitting of an infinite number of combinations, from that of two or three machines to that of all those on the same floor or in the same shop; 3. The building in of a motor as a part and parcel of each and every machine tool. *Power*, March, '95.

Utilization of the Niagara Falls. By E. Boistel. Description of part of the electrical installations. *L'Eclairage Electrique*, May 4, '95.

Polyphase Currents for Lighting and Power in a Factory. By M. P. Boucherot in *Bull. de la Société Internat. des Electriciens.* In deciding whether alternating or continuous currents should be used, the following points had to be considered: 1. Available capital; 2. Efficiency of system; 3. Practical advantages and disadvantages; 4. Cost of maintenance. Two-phase currents were chosen. *Elec. Review*, May 8, '95.

Mechanical Applications of Electricity. By Gustave Richard. Description of various electrical elevators, cableways, etc. *L'Eclairage Electrique*, May 11, '95.

Handling Coal by Electricity. An extensive coal handling plant, operated entirely by electricity, has been running in San Francisco since February. The owners were confronted with the problem of unloading coal rapidly from the steamships and colliers at the wharves, and distributing it to the wholesale and retail trade most economically. In the dynamo room are two tandem compound high speed 135 H. P. engines, running at 265 revolutions. Belted to these are two 90 kilowatt, 250 volt compound-wound dynamos, running at 700 revolutions per minute, and over-compounded 10 per cent. *Western Electrician*, May 25, '95; *Elec. Review*, May 29, '95.

Possibilities of Electrical Pumping Machinery. By Chas. A. Hague. Paper read before the Atlanta meeting of the Am. Waterworks Ass'n. The convenience and controllability of electrical power together with its simplicity of application to the work of pumping, commends it very strongly for use in isolated places, such as high service systems in public water supply, wherein a comparatively small percentage of the total water supplied by the initial plant is needed for dwellings situated upon levels too high to be accommodated by the general pressure.

The application of electrical energy to the pumping of the main supply of a city of considerable size, although presenting many attractive features, as far as the actual operation of the pumps is concerned, is not yet within the possibilities on account of the absence of inexpensive methods for producing the necessary current; so that, apparently, in pumping large quantities for some time to come, the compound, the triple, and the quadruple steam pumping engine will hold their sway. *Industries and Iron*, June 14, '95; *Elec. Engineer*, June 12, '95.

Electrically Driven Printing Presses. The description of the application of motors for printing presses, one of the principal advantages being speed, also cleanliness, ease of control and saving of power. *Elektrotechn. Anzeiger*, June 13, '95.

Electrically Driven Refrigerator Machines. A description of a small 4 H. P. refrigerator where the motor is built on the same base with the machine; incidentally the manifold uses of a refrigerator are pointed out. *Elektrotechn. Anzeiger*, June 16, '95.

Cost of Steam Power in Buffalo. By Horatio A. Foster. Writer points out the principal points of mismanagement in factories and mills, and then gives the following table, based on actual results obtained in Buffalo.

Plant No.	Average Horse-Power Used Between	Hours Run per Day.	Cost per Horse-Power per Annum.
1	40 and 50	24	$149.58
2	200 " 300	24	48.19
3	3,000 " 4,000	24	62.64
4	30 " 40	24	233.95
5	200 " 300	24	53.37
6	50 " 60	24	131.12
7	20 " 30	24	151.54
8	1,300 " 1,400	11	32.70
9	50 " 60	15⅓	76.45
10	20 " 30	9	108.27
11	10 " 20	9	173.33

Elec. Engineer, June 26, '95.

Electric Power in Factories and Mills. By F. B. Crocker, V. M. Benedict and A. F. Ormsbee. Paper read before the annual meeting of the Am. Inst. of Elec. Engineers. The many advantages of electric power in factory and mill work are enumerated as follows: 1. Clear and unobstructed passages and head room, the latter facilitating the use of traveling cranes. 2. Ease of shifting the tools

from place to place, possibly necessitating the placing of a starting box and the putting up of a little extra wire, as compared with the inconvenience and trouble of setting up and adjusting a line of shafting, hangers, belts, etc. 3. The economy due to the ability to run a single tool without necessarily starting the whole factory, or at least a complete section. 4. The running expense is entirely stopped when the tool is shut down. 5. The absence of the drip of oil from overhead shafting. 6. The tools may be placed at any desired point almost regardless of the distance. 7. It is not necessary to arrange the tools parallel as in the mechanical system. 8. A wider range of speed is possible. 9. Less damage caused by a fuse blowing than by a belt slipping off in case of accident or excessive load. The results of a large number of tests are given, showing the power required to operate different kinds of machine tools and several plants are described in which this method of supplying power is satisfactorily used. It is stated that practically the only objection that can be urged against the electric system is the fact that the first cost of installing is greater than the cost of belting and shafting, though there are cases in which the reverse is true. In almost all cases the amount of power consumed in an electric system is less than with the usual one, which is explained by the high efficiency of the dynamo and motor as compared with the lower efficiency of belt transmission. Perhaps the greatest saving, however, is due to the fact that the consumption of energy entirely ceases when the tool stops. This saving in the busiest tools amounts to at least 25 per cent., and with large and special tools is even as large as 50 per cent. or 75 per cent. of the nominal working power. Another very important advantage gained with the electric system is the increase of output which is secured by the greater convenience and promptness in starting and stopping as well as in regulating the speed of the machinery. The flexibility of the system adds another advantage, and the simplicity of regulation is extremely simple and effective. *Electricity*, July 3, '95; *Elec. Engineer*, July 10, '95; *Elec. World*, July 13, '95; *Elec. Review*, July 31, '95; *Elec. Industries*, August, '95.

To Europe in Three Days. There was recently on exhibition in Washington a miniature model of a vessel designed by Mr. Richard Pamton to cross the Atlantic in three days. The stern propellers are three-bladed, two on a shaft, about two diameters apart. The blades are set so that the blades of the rear propeller cover the space between the blades of the one in front of it. The inventor uses his main engine to generate electricity and then drives motors. He claims to be able to generate 100,000 H. P. *Inventive Age*, June, '95.

Electric Driving of Tools in the Baldwin Locomotive Works, Philadelphia. A 250 H. P. engine can easily do the work now that a 500 H. P. engine did formerly, and principally on account of the vast amount of work saved by having done away to a great extent with belting and countershafts. *Am. Machinist*, June 6, '95.

Long Distance Transmission at 10,000 Volts (The Pomona Plant). By George Herbert Winslow. Paper read before the Am. Inst. of Elec. Engineers, June 27, '95. This plant has been in successful

operation for over two years and is used to transmit energy from a waterfall to sub-stations at Pomona, 13¾ miles distant, and San Bernardino, 28¾ miles distant, from which points it is distributed for incandescent and arc lighting. It consists of a Pelton water power plant and a Westinghouse alternating-current transmission plant in which generators supply currents to sets of rising and lowering transformers operating at 10,000 volts, and delivering current to the local circuits at 1,000 volts. There are two 120 K. W. alternators of 1,140 volts and 60 periods, and oil transformers of a corresponding capacity. The primary coils of the latter are connected in multiple with the respective alternators and the secondaries in series, the Pomona and San Bernardino circuits being separate and run from independent machines. *Elec. World*, July 6, '95; *Elec. Review*, July 17, '95; *Elec. Engineer*, July 24, '95; *Electricity*, July 31, '95.

Electric Distribution in Shops. By Mr. Brunswick. Experimental results of several European workshops. *L'Eclairage Electrique*, June 8, '95.

The Westinghouse Electric and Manufacturing Company's New Plant. The first of a series of articles describing in detail these new works. *Elec. World*, June 22, '95.

Work that has been Done at Niagara. A very fine review of the development and principal installations. *Elec. Engineer*, June 26, '95.

Electric Distribution of Power from Gas Engines. Captain Lenevue, of France, has recently made a report upon the power installation at M. Linet's chemical works at Aubervilliers, near Paris. Power is generated by gas engines worked with poor gas and transmitted by electricity throughout the works. Results of test are given in *Scientific American*, July 6, '95.

Electrically Driven Turntables. By H. Cox. Description of the method employed in the Stuttgart railway station. *Elektrotechn. Anzeiger*, July 21, '95.

Power Transmission and Lighting Plant in the Brooks Locomotive Works, Dunkirk, N. Y. This plant consists of a 130 kilowatt dynamo at 225 volts. Transfer table is equipped with a 40 H. P. motor, the elevator in the foundry is operated by a pump, which latter is directly connected to a 6 H. P. motor. *Elec. Industries*, August, '95.

Electricity Works "La Goule." By Dr. E. Blattner. This is one of the largest transmission plants in Europe, since it furnishes eleven separate towns with current. The waterfalls have an average height of 26 metres, and the average quantity of water is 15 cubic metres per second. The single phase alternating current is used, the lighting system being run entirely separate from the power line. The radius of distribution is about 15 English miles. The single phase system was selected because only small motors (jeweller's lathes) are run from the power circuit. For complete description of plant compare *Elektrotechn. Zeitschrift*, Aug. 1, '95.

An Economical Aspect of the Niagara Power Plant. By Arthur Vaughan Abbott, C.E. Some criticism on the plant and a discussion as to its future success. *Elec. Engineering*, August, '95.

Electric Furnaces. By Girard and Street. The arc, after being formed, is made to revolve in consequence of a variable magnetic field, which surrounds the furnace on the outside. *Elektrotechn. Anzeiger*, Aug. 11, '95.

Double Swing Bridge Operated by Electric Power. This bridge is operated by electricity, and all auxiliary motions are accomplished by compressed air, the compressor being driven by an electric motor. *Western Electrician*, Aug. 24, '95.

Electric Haulage in Marquette Mines. A description of the electric haulage systems in use at the Lake Angeline West End Mine and the Lake Mine of the Cleveland Cliff Co., taken from *The Mineral Industry*, volume for 1894. The voltage is 550; revolutions of motor per minute, 900, winding and wiring for a 10 per cent loss. The motors are iron-clad, water-proof turtle backs, and handle six cars carrying 2½ tons each. *Iron Trade Review*, Aug. 29, '95.

Electrifying Iron. The big Cottonwood Power Transmission, Salt Lake City, Utah. By Geo. Heli Guy. A complete and well illustrated description of the installation. *Elec. Engineer*, Sept. 11, '95.

Two Phase Alternating Current Power Distribution System at the Milwaukee Harvester Works. In the foundry a 50 H. P. motor drives the fans of the cupolas. A 5 H. P. motor in the harvester room is used to run the harvesters after they are set up while being tested. Elevators are operated by 7½ H. P. motors. 200 incandescent lamps are wired from the same circuits, and 80 lights are wired from the exciter. Generating plant consists of 100 kilowatt two-phase alternator. A plan of the works accompanies the articles in *Elec. Industries*, October, '95.

Electric Pumps for Water Works. By John M. Godell. Paper read before the Am. Water Works Assoc. Paper contains some results of tests made as to cost. *Am. Gas Light Journal*, Oct. 14, '95; *Elec. World*, Oct. 5, '95.

Electric Motors. It is shown in this article how to use a street car direct current motor temporarily for power purposes as a stationary motor. Diagrams of connections and methods of arranging resistances are added in order to illustrate the descriptive part. *Street Railway Gazette*, Oct. 5, '95.

Electrical Utilization at Portland, Ore., of the Power of the Falls of the Willamette River. The details of a plant, the ultimate capacity of which is to be over 12,000 horse power, is described minutely and well illustrated in *Western Electrician*, Oct. 12, '95.

Electric Elevators. Translated from *La Nature*. After a brief review of the elevator development, the comparative economy between various types of elevators is discussed. The net cost of a

complete travel of a three-passenger elevator is calculated as follows :

Hydraulic elevators	Francs 0.165
Compressed air	0.077
Hydro-electric	0.045
Electric	0.025

The writer claims that, on the whole, electric elevators present great economic advantages, while at the same time realizing the same conditions as other elevators. They do away with a large expenditure of city water and become during the day important centres of consumption for central stations of electric energy. *Scien. Am. Supplement*, Oct. 26, '95.

Electricity on the Erie Canal. The Cataract General Electric Company began on September 30th the erection of the poles for the test of electric power on the Erie Canal. The section selected for trial is in the neighborhood of Tonawanda, which includes a fairly sharp curve, and where all the conditions will be of considerable difficulty and will give a full trial of the system. The question of passing trolley and mule boats will be fully tested. *Egineering and Mining Journal*, Oct. 12, '95.

Electricity on the Erie Canal. Review of the experiments made during the last few years, and a clear description of the new experiments and requirements. *Elec. Engineer*, Oct. 30, '95 ; *Western Electrician*, Nov. 2, '95.

Limits of Electric Power Transmission. By Alton D. Adams. Author states his ideas by applying them to a definite problem. *Engineering Magazine*, Nov., '95.

Distribution of Power in Collieries. By Llewelyn B. Atkinson. To decrease the cost at the collieries, there are broadly three courses : 1. To decrease the payment per ton to the mineral owner; 2. to decrease the wages cost per ton raised ; 3. to decrease the fuel expenditure per ton raised. It is the third course which is dealt with in detail in this paper. *Engineering Magazine*, Nov., '95.

Electric Heating of Rooms with Water. This is, according to a communication of the *Techniker*, the latest invention on heating of rooms. It is based on the fact that the electric current reduces water to hydrogen and oxygen. In a reservoir of water of middling size the two wires of conduit are soldered to the bottom ; their poles are provided with platina plates and on the poles two glass cylinders are fixed hermetically. The poles are within the water, and therefore, when the current is formed, one pole develops hydrogen and the other oxygen. These two gases are conducted through a cock with two concentrical openings. The hydrogen passes through an outside slit, and, when lighted, produces a strong flame, the intensity of which, however, is increased to 1200° Réaumur by the addition of the oxygen, leaving the cock by the inner circular slit. This flame is led to a fire-brick plate, which within 30 minutes is heated so as to give a white flame heat, which is used for the heating of the room. *Helios*, Nov. 1, '95.

Typical Electric Elevator Plant. Illustrated description of a modern installation in Chicago. *Western Electrician*, Nov. 9, '95.

Electrical Developments at Niagara. Ground has been broken for a factory to manufacture calcium carbide on a large scale. Furthermore, chlorate of potash will be produced by a company which has rented 700 H. P. for this purpose. *Elec. World*, Nov. 9, '95.

Alternating Current Installation at Ardieres. A plant in which two alternators of 3,500 volts are put in multiple, one-half being sent directly to Ardieres without step-up transformers; the other to three different places, under a pressure of 10,500. Various difficulties which occurred with insulation are explained and their remedies pointed out. *Elektrotechn. Anzeiger*, Nov. 17, '95.

Bus Bars and Cables in the Niagara Power House. Description of cables and methods of connections to the switchboards. *Elec. Engineer*, Nov. 20, '95.

Inefficiency of the Direct Methods of Converting Heat into Electrical Energy. By Leon de Pontois. Paper read before the Engineers' Society of Western Pennsylvania. *Electricity*, Nov. 20, '95.

Distribution of Electric Power at Niagara. By Franklin Leonard Pope. An article in which the question of long-distance distribution is discussed. Owing to the sudden death of the author, his brother, Mr. Ralph W. Pope, brought the article to a close. *Engineering Magazine*, Dec., '95.

Direct Versus Alternating Currents for Long-Distance Transmission. By Wm. Baxter, Jr. An article which tends to favor the direct current transmission. *Elec. Engineer*, Dec. 4, '95.

Electrical Equipment of the Carborundum Works, Niagara Falls. By Orrin E. Dunlap. Furnaces, wiring, operation, etc., described and illustrated in *Western Electrician*, Dec. 7, '95.

Electricity in Stone Quarries. After pointing out the manifold advantages of electric motors over steam power distributed through the quarries, the article brings out in sufficient detail the plant installed at Soignies, Belgium, and furnishes several illustrations of the quarries. *Western Electrician*, Dec. 7, '95.

A Giant Electric Crane. Description of a high speed electric hoisting and conveying machine used in ship building. *Elec. Review*, Dec. 11, '95.

Possibilities of Long Distance Transmission from Electric Railway Steam Plants. Discussion of the economy of centralized and subdivided power. *St. R'y Review*, Dec. 15, '95.

Electrical Elevators. By E. Hospitalier. Writer gives reasons for the slow development of electric elevators in Paris during the last few years, and says that the increased price for water-power during the last few years has brought them to the front. He speaks highly of the American elevators, and speaks of the "fantastic speed" of three metres per second. *L'Industrie Electrique*, Nov. 25, '95.

Electric Motor in Mill, Mine and Factory. By E. L. Heinrichs. A short article, mentioning the progress and the possibilities of the electric motor in factories. *Iron Trade Review*, Dec. 26, '95.

MISCELLANEOUS.

Fly-Wheel Accidents. For the last two months or more there are many discussions on fly-wheel accidents, with valuable suggestions by able men. Space does not allow here to enumerate all names and dates, but we refer to the *Elec. World* during November and December issues, '94.

An Automatic Commutator Oiler. An invention of Mr. L. Fawcett, particularly for the Brush dynamo. *Pacific Electrician*, Dec., '94.

The Enigmas of the Elements. The Marquis of Salisbury's annual address at the meeting of the British Association in Oxford. *Elec. Age*, Dec. 1, '94.

Armature Disc Cutting. By Oberlin Smith. A paper treating the different kinds of dies for cutting discs: *Elec. Engineer*, Dec. 5, '94.

Electricity on Shipboard; Its Present and Future Development. By S .Dana Greene. Abstract of a paper read before the Institute of Naval Architects and Marine Engineers, Nov. 15, 1894. See Synopsis of December, also ELECTRIC POWER, Dec.; *Elec. Review*, Dec. 5, '94.

Wire Losses, Over-compounding of Dynamos, and Regulation of P. D. in Multiple Arc Circuits. By E. P. Roberts. A short discussion, partly in answer to inquiries and criticisms. *Elec. World*, Dec. 8, '94.

Electrical Conductors. The law which has been established in Paris in regard to current carrying wires, other than for telegraph or telephone. *L'Industrie Electrique*, Dec. 10, '94.

Thomson's Law. A discussion of the same leading to the following conclusion: It is not a general law, but only the solution of the particular case, in which the current flow is constant. *L'Industrie Electrique*, Dec. 10, '94.

The Electric Problem with Reference to Fires and Firemen. By Mr. G. P. Lowe, Electrical Inspector, San Francisco, Cal. Those features of the use of electricity which are of concern to firemen may be summarized in general, as follows: 1. Electricity as a Fire Producer; 2. Electrical Appliances as an Interference with the Duties of Firemen in Combating Fires; 3. Electric Light and Power Stations, Telegraph and Telephone Offices and the Fires Therein; 4. Impairment of the water mains by electrolysis; 5. Electricity in the fire department service. These points are considered in detail in *Am. Gas Light Journal*, Dec. 17, '94.

A "Hire-Purchase" System for the Electric Wiring and Fitting Work. By John H. Rider, M. I. E. E. In order to induce people to put electric light wires into their buildings without being

burdened with the high initial cost, the writer proposes a sort of instalment plan, which he claims to be successful. His plan is given in detail in *Lightning* (London), Dec. 20, '94.

Recent Electric Plowing Experiments in Germany. A new kind of electric plow with comparative cost, showing the expense to be less than one-half that of animal power. *Elec. Engineer*, Dec. 26, '94.

Proposed Regulations for Electric Light Installations in Germany. The Technical Committee of the Berlin Electrotechnical Society have drafted regulations proposed to be adopted in Germany in regard to the precautions to be taken where powerful currents are used, to prevent danger from fire. Inspection Rules; Precautions for Safety; Engine or Work Rooms; Ordinary Business, Living and Work Rooms, Damp Rooms and finally Rooms where Fire Risk is great, form the principal headings. *London Elec. Engineer*, Dec. 28, '94.

The Positions and Prospects of the Electrical Industry. By Robert Hammond, M. I. E. E. A most encouraging view expressed as to the future possibilities of Great Britain. *Lightning*, Jan. 3, '95.

High Pressure vs. Low Pressure. By Rankin Kennedy. Since in most cases the alternating current system requires a low tension distribution, the question of high versus low pressure principally refers to feeders. This problem is briefly discussed by the writer. *Lon. Elec. Review*, Jan. 4, '95.

A Study of Different Varieties of Graphite. A note presented before the Academy of Sciences (Paris) by Henri Moissan. The graphites investigated were prepared by two kinds of processes. 1st, under the influence of high temperature; 2nd, crystallization under the influence of metallic solvents. *L'Électricien*, Jan. 5, '95.

Cooking by Electricity. By H. J. Dowsing, M. I. E. E. In the series on "Electricity for the Million," we find a popular article on the above subject, with a number of illustrations. *Lightning*, (Lon.) Jan. 10, '95.

Electricity and Plant Growing. By L. H. Bailey. An abstract of a paper on this subject contributed to the transactions of the Massachusetts Horticultural Society appears in *London Elec. Engineer*, Jan. 11, '95.

Notes on Protection against Lightning, collected during the summer of 1894, by Alexander Jay Wurts. The best way to protect power stations from lightning is pointed out, and instances given where, through ignorance or carelessness, arresters did not protect. ELECTRIC POWER, Feb., '94.

Some Hints and some Errors in Electric Construction. By George T. Hanchett. Some concise and practical rules and instructions are given in regard to wiring buildings, together with a description of the inverted arc lamp. ELECTRIC POWER, Feb., '95.

A Critical Resumé. By M. I. Pupin. The first part of a detailed and elaborate review of H. Poincaré's book: Les Oscillations Electriques. ELECTRIC POWER, Feb., '95.

Recent Growth of Electrical Engineering. By Major S. Wood Page, Vice Chairman of the Edison-Swan Electric Company. The writer points out that the first central station established in England was started in 1882, and then goes back to give a review of the history of the electric light. *London Engineering Review*, Jan. '95. To be continued in subsequent issues.

Notes on Recent Electrical Engineering Developments in France and England. By H. Ward Leonard. A paper read before the Am. Inst. of Elec. Eng's, treating principally the following points: Alternating Current Practice; Manufacturing and Engineering; Rotary Transformers; Steam Engines; Parson's Turbine; Laval Steam Turbine Five-wire System; English and French Central Stations; Importance of the Load Factor in Central Stations; Heilmann Locomotive. *Trans. Am. Inst. Elec. Eng's*, Feb., '95.

Novelties in Paper for the Electrical Profession. Description and a number of tests with a new material called "Isolit," and used for tubing, lamp reflectors, battery cases, isolating plates, magnet spools, etc. *Elektrotechn. Anzeiger*, Feb. 7, '95.

Governing of Steam Engines by Throttling and by Variable Expansion in Central Electric Light Stations. By Captain H. Riall Sankey. The author discussed electric light engines; showed various load diagrams; compared condensing with non-condensing, and finally considered engines used in the electric tramways and railways. *London Elec. Engineer*, Feb. 8, '95; *Industries and Iron*, Feb. 8, '95.

The Mechanical and Electrical Regulation of Steam Engines. By John Richardson, M. I. C. E. After describing mechanical methods for steam engine regulation, the electric regulation of engines was dealt with.

The paper concluded with a description of a method of electric control of a valve gear which was suitable for engines of large size, the power required to govern the lever being practically nil, a small solenoid and a slight current being found sufficient to effect the entire control of engines up to 1,000 horse-power. An automatic method of stopping or slowing the engine, should there be an accidental breaking of the governor circuit, was also illustrated by drawings and working models. *London Elec. Engineer*, Feb. 8, '95.

Electricity in Agriculture. A calculation according to which it costs $10.25 to plow two hectars of land, while animal power costs $12.50. *L'Electricien*, Feb. 9, '95.

Trolley Mail Service for Philadelphia. In his annual report, Postmaster Carr of Philadelphia makes reference to trolley mail service. He does not think it advisable at present because most roads are single track. *St. R'y Gazette*, Feb. 9, '95.

Electrically Operated Rolling Lift Bridge. The new bridge that spans the south branch of the Chicago River at Van Buren Street is of exceptional interest to engineers. It is wholly dependent on electric power for operation, being equipped with 200 horse-power in motors. The complete description of the bridge, with a number of illustrations, appeared in *Western Electrician*, Feb. 9, '95.

Interior Conduit and Interior Wiring. By Chas. E. Burton. A paper read before the Northwestern Electrical Association. After the various methods of interior wiring are briefly discussed and the advantages and disadvantages of the various systems enumerated, with special reference to safety, the author says: In view of the fact that interior conduit meets with the approval of the underwriters as an ideal method of concealed permanently accessible construction, and meets the requirements of engineers as a permanent mechanical protection for interior wiring, we can but see for it a future of universal adoption. *Am. Gas Light Joural*, Feb. 11, '95.

Application of the Electric Arc System of Welding to Machinery and Boiler Materials. By Henry Foster. The writer says, that at present we have two systems, first, the Thomson-Houston, in which the heating effect induced by the resistance to the passage of the electric current through the articles to be welded together, accompanied by a certain amount of pressure between the parts thus heated is made to produce the required weld; and secondly, we have the Benardos or arc system, in which the article to be operated upon is made to constitute one pole of the electric circuit, while a carbon pencil attached to a portable insulated holder, and held by the workman, constitutes the other pole, the electric arc—which is the heating agent of the process—being struck between the two poles thus formed. In this paper the writer proposes to confine his remarks and illustrations exclusively to the Benardos or arc system of welding. *London Elec. Engineer*, Feb. 15, '95.

A Novel Electric Furnace for Heating Iron Strip. The object to be tested can be brought into contact with another body previously heated by the passage of the current. An apparatus explained and illustrated in *Age of Steel*, Feb. 16, '95.

On Central Stations for Agricultural Purposes. By F. Grünwald. The writer points out that farming might be accomplished cheaper with electrical than with animal power. *Electrotechn. Anziger*, Feb. 24, '95.

On the Application of the Electric Arc to Machinery and Boiler Repairs, etc. By Henry Foster. From the Transactions of the North East Coast Institute of Engineers and Shipbuilders. See Synopsis of May issue also, *Industries and Iron*, March '95.

Incombustible Electric Cables. Report of tests made on a new cable, called Salamandre. *L'Electricien*, March 2, '95.

The Electric Annealing of Armor Plate. By Elihu Thomson. "The process consists essentially in passing a current between two electrodes placed at a certain distance apart on the plate surface, and thereby heating a portion of the plate to an annealing temperature, after which by a very gradual and careful diminution of the current, the temperature is slowly lowered so that the too rapid cooling by conduction of heat to the massive plate back of the heated portion, shall be prevented from acting as a chill upon the heated metal." *Elec. Engineer*, March 6, '95.

Electric Haulage of Vessels through Canals. By G. Lestang. The writer explains the Bouet system, which is an aerial trolley line, the current being taken from an anchored chain. *Revue Industrielle*, March 9, 95.

Electro-Magnetic Ore Separators. By H. Kessler. The principle of the separation is based on the attraction of the small iron particles to pencils, which become magnetic alternately. *Die Elektricität*, March 16, '95.

Explosions in Underground Mains and Suggestions How to Prevent Them. By Arthur Shippey. Writer divides the subject under three headings: 1. Those brought about by carelessness. 2. Those proved to be short circuits, faulty fuses, corrosion, overheating of the main cables, sparking, etc., and, 3. Those that frequently occur, the cause of which as yet remains unsolved. The author's theory is that many explosions have taken place by lightning flashes being conveyed to the earth through lightning conductors. He supports Sir David Salomon's suggestions as to filling up the open spaces and manholes with small sandbags, in order to prevent excessive accumulation of explosive gases. *Elec. World*, March 16, '95.

Electric Wiring and the Fire Hazard. By F. E. Cabot. The writer investigates the causes of fires. *Engineering Magazine*, March '95; *Am. Gas Light Journal*, March 18, 95.

An Electric Carriage of M. Jeantaud. Description with illustration in *Scientific American*, March 23, '95.

Electrical Condition of Buried Conductors Due to Leakage Currents from Electric Railways. By W. Stuart Smith. The second of a series of articles gives results of observations at a great many places and therefore does not allow of a short abstract. *Elec. World*, March 30, '95.

Niagara and the Great Lakes. By Frank Bursley Taylor. This article has nothing to do with electricity, but is simply geological. We give it mention here because Niagara and its power is of vital interest at the present time. The article is of interest to the technical as well as non-technical reader. *Am. Journal of Science*, April, '95.

Jeantaud's Electric Carriage. Description of the carriage which is to compete against steam and petroleum carriages. *Elec. Review*, April 3, '95; *Elec. Engineer*, April 3, '95.

Electric Mains in Paris. By A. Monmerque. From *L'Eclairage Electrique.*

It will be useful to note the experiences gained in the last five years, and to review the principal faults found during that time. The conclusions which the facts point to are the following, which seem now to be well established in spite of adverse opinions held in the past by some engineers.

1. When the electric conductors are placed in metallic envelopes for mechanical protection, it is necessary to take great care to prevent any chance contact between the copper conductor and the envelope. To ensure this it is necessary to use insulated cables, and

to take similar precautions as are required when armored cables are employed and laid direct in the ground.

2. The conduits used, specially with bare conductors, ought to be waterproof, and as this condition cannot always be assured, a good system of drainage should be provided.

3. There is reason to specify the materials allowable in the construction of the conduits, and in this direction to forbid the use of glazed earthenware.

4. Where insulated conductors are employed the method of supporting them in the conduits should receive special attention to avoid mechanical injury to the insulation, and consequently a low insulation resistance.

These very simple conclusions are extracted easily from the results which are given as briefly as possible. *London Electrical Engineer*, April 5, '95.

Practical Testing. By W. H. Freedman and Max Osterberg. Authors explain the following resistance measurements: Field coils by bridge method; armature by bridge method; insulation resistance by direct deflection. ELECTRIC POWER, April, '95.

Conductors and Insulating Compounds is the heading to a list of conductors and insulators. Of the latter there are so many that they are classified in alphabetical order. A little over 250 separate and distinct materials are named. *Elec. Review*, April 10, '95.

Aluminium Utensils. A complete field outfit of cooking utensils, consisting of 16 pieces and weighing six pounds. *Age of Steel*, April 13, '95.

Ferry Service with Electric Boats in Bergen. Description of boats with data of costs for installation. *Elektrochem. Zeitschrift*, April 18, '95.

Application of the Electric Arc to Machinery and Boiler Repairs. Abstract of a paper read before the N. E. Coast Engineers and Shipbuilders, by Henry Foster. For repairs to boilers, especially where defects are of the order known as grooving, this process seems particularly applicable. *London Elec. Review*, April 19, '95.

Practical Wiring Specifications. By A. E. Dobbs. A short article in *Elec. Engineer*, April 24, '95.

Use of Electricity for Heating and Cooking. Siemens, Cowles, Lane-Fox and Carpenter may be hailed as the pioneers of the art of applying electricity to heating and cooking. A number of curves show the time it takes to perform certain work. *London Elec. Review*, May 3, '95.

Recent Advances in American Electrical Engineering. A review of the work done in this country during the past year, taken from the reports of the Secretary of the Franklin Institute. *Western Electrician*, May 18, '95.

Electric Plowing in Germany. In Halle on the Saale successful experiments have been made. A steam plow with portable engines costs from 40,000 to 60,000 marks, while a four-furrow balance plow

with electric motor and reversing gear, as well as 250 meters of chain, two anchors, 600 meters of insulated cable and six cable cars costs 10,000 marks, while the entire outfit for a three-furrow plow costs 8,000 marks, and for a two-furrow plow 6,000 marks. In addition to this the dynamos will cost 5,500 marks, 4,000 marks and 2,000 marks respectively. *Western Electrician*, May 18, '95.

Electrical Underground Conduits and Cables. By Wm. Maver, Jr. Writer gives some particulars of the Detroit tunnels; he then discusses in detail solid conduit and bare wire conduit. ELECTRIC POWER, May, '95; continued in subsequent issues.

Thermo-Electric Generator for the Conversion of Heat Directly into Electrical Energy. By Harry B. Cox. Description of a new apparatus which gives, according to the claim of the inventor, actually practical results. *Elec. Engineer*, May 1, '95.

Interior Conduit Wiring. By Fred. Bathurst. Writer deals with the problem under three main heads: 1. Efficiency of the source of generation; 2. Efficiency of distributing system; 3. Efficiency of receiving or transforming end. *Lightning*, May 23, '95.

Costs of Electricity in Agriculture. A complete description of a water power plant in which it is shown by actual figures based on experience and special experiments, that a considerable saving was effected by the new installation. *Die Elektricität*, May 25, '95.

Effect of Temperature Upon Cotton and Silk Insulation. By Frederick C. Reeve, E. E. At what temperature the safety limit for cotton and silk should be placed, and the study of their action above or below this limit, is the object of this investigation.

After a careful description of the apparatus and methods of making tests, the writer gives his results in form of tables and finally draws the following conclusions:

(*a*) That most machines of to-day are run at a temperature where their insulation is the lowest unless careful protection from the absorption of moisture. This is very important with high E. M. F. machines and may be an explanation of some otherwise unaccounted for breaking down of the machine's insulation.

(*b*) That baking at a temperature of 150° C., and then protecting the insulation from the absorbtion of moisture will vastly improve it. Not varnish or shellac first and then baked afterward, as is done to-day.

(*c*) That cotton and silk are not injured mechanically or chemically up to 180° C. (356° F.) and that this point is always the same and hence very definite. A few degrees above this are sufficient to rapidly scorch it. This is very important, placing the limiting temperature value much higher than is now generally thought to be possible.

(*d*) That copper will oxidize quite badly, considerably below 180° C., hence the wire itself is injured somewat before its insulation.

ELECTRIC POWER, June, '95.

Electricity for Marine Propulsion. By Prof. W. E. Durand. We will now recapitulate the principal points thus far developed. For

equal amounts of energy embodied, storage batteries weigh about 550 times as much as coal, and occupy ahout 220 times as much space. For equal amounts of work on the shaft, the batteries weigh about 40 times as much as coal, and occupy about 16 times as much space. For the same power developed, the weight of electric motors is considerably less than that of ordinary steam machinery, while the space occupied is so small as to be well-nigh inconsiderable when compared with that required for boilers, engines and auxiliaries. For equal amounts of energy embodied, the cost of charging batteries is about 100 times the cost of coal. For equal amounts of work on the shaft, the cost of charging batteries is about 7 times that of coal. For equal amounts of work on the shaft, electric propulsions will require the initial consumption of nearly twice as much coal as with steam propulsion direct, the two steam engines involved being of about equal efficiency. For equal power on the shaft, electric motors will cost nearly as much as total steam machinery. The initial cost of batteries is an item having no exact parallel in propulsion by steam machinery. The cost depends on both power and time. *Cassier's Magazine*, June, '95; copied in *Elec. Review*, June 19, '95.

Electric Welding of Metals. By P. Taboury. A description of a method evolved by H. Zerener. *L'Eclairage Electrique*, June 29, '95.

Properties of Fuse Metals when Subjected to Short Circuits. By Walter E. Harrington. Paper read before the Am. Inst. of Elec. Engineers, June 25, '95. The writer shows that fuse metals are in his opinion not an adequate means for protection from short circuits. *Elec. Engineer*, July 3, '95; *Western Electrician*, Aug. 10, '95.

Electric Welding. By Hermann Lemp. An interview on this subject published in *London Lightning*, July 4, '95.

Burton Liquid Electric Forge. By W. M. Ker. Writer points out the economy and convenience of using an electric forge. *Elec. Engineer*, July 17, '95.

The Design of Transformers. By George Adams. Transformer design is a subject which offers considerable scope for the skill of the electrical engineer. The subject being a large one, this article will be confined to those transformers having a closed magnetic circuit, and to be connected in parallel on constant potential mains. This type of transformer is by far the most frequently met with in practice; open circuit transformers, and transformers for constant current or series work, being a very small class, destined probably to become smaller. *London Elec. Review*, July 19, '95.

Underground Wires in Boston. By J. E. Talbot. There are in use in Boston 220,000 incandescent lamps, 6,600 arc lamps, and the total amount of electrical energy generated aggregates 28,000 horse-power. Mileage of underground telephone wires is 11,200 miles. *Elec. World*, July 20, '95.

A New Electric Organ. Electric organs have hitherto been a dismal failure, owing to the complicated mechanism used in their con-

struction, but in this instrument such simple means have been adopted as to point to a very successful career for the new invention. Up to the present time electricity has been employed in organ building for the purpose of operating small pneumatic valves, which admit air under high pressure into another set of large valves, which in their turn operate the valve or pallet. The abolition of the pneumatic valves has long been felt desirable, but the heavy touch of large organs has caused organ builders to use them in order to render the instrument playable.

The organ is operated by a direct electric system. There is no intermediary between the magnet and the valve, therefore the response is absolutely instantaneous.

The mechanism for coupling the different keyboards to each toher or to the pedals—which is entirely electrical—is as simple as it is ingenious. There are no draw stops, but instead a small keyboard is placed above the swell keys, from which the various stops are controlled. Pistons placed beneath the keys control the stops in various combinations, which may be either fixed or changeable by means of a small switchboard placed inside the organ, where the organist may vary any of the combinations to suit his own taste or the requirements of the music. Another piston enables the organist to throw on the full organ at one touch. All the pistons are reversible, shutting off all stops not required in the combination.

In the electro-magnetic apparatus in the organ, about twenty-five miles of copper wire have been used, and the number of connections made for the conveyance of current to all parts of the instrument has been about 10,000. *Canadian Engineer*, August, '95.

Electrical Interference. By Arthur Vaughan Abbott, C. E. Paper read before the Northwestern Elec. Ass'n, July 17, '95. Electrical circuits often exercise a very serious mutual interference with each other, and occasionally become sources of danger to both life and property, and it is therefore pertinent to inquire into the conditions giving rise to such interference, and the possible remedies. For convenience in treatment, the author divides the subject into four general heads: 1. Leakage; 2. Inductive disturbance; 3. Common path interference, and 4. Electrolytic action. *Western Electrician*, Aug. 10, '95; *Elec. Review*, Aug. 7, '95.

Meyer System for Instantaneously Stopping Machinery. By Lucien Meyer. The object is to enable workmen, by means of a series of electric pushes placed at convenient places in the shop, to instantly bring the machinery to a standstill at the first cry of distress uttered by a comrade in danger. His invention consists of a group of apparatus capable of acting together or separately. *L'Electricien*, July 27; in abstract in *LondonElec. Engineer*, Aug. 9, '95.

Preparation of Electrotype Moulds. Abstract of a book by Julius Weiss. Published in *Scientific American Supplement*, Aug. 24, '95.

Electricity Applied to Steering Vessels. By Wilh. Gentsch. Details of various methods are described and illustrated in *Elektrotcchn. Anzeiger*, Aug. 25, '95, and subsequent issues.

Electrically Lighted Buoys. By Ira W. Henry. History of the developments with special references to New York harbor. ELECTRIC POWER, September, '95.

Whitacre-Wolfe Iron Separator for Clays and Ores. Illustrated description of a new machine. *Elec. Engineer*, Sept. 4, '95.

Mechanical and Electrical Regulation of Steam Engines. By John Richardson. Taken from the proceedings of the Institute of Civil Engineers. *Amer. Machinist*, Sept. 19, '95.

Some Points in the Manufacture of Vulcanized India Rubber Covered Cables and Wires. By J. Warren. Article showing various cuts of machines used in the manufacture. *London Electricity*, Sept. 20, '95.

Electrically Driven Angle Iron Shearing Machine. A machine adapted to square cutting, or for cutting at mitres or other angles, either right or left hand. *Age of Steel*, Sept. 21, '95.

Electricity in the Astronomical Observatory. By J. T. Monell, C.E.,E.E. ELECTRIC POWER, October, '95.

Principle of Invention. By Edward P. Thompson. Author considers "Rotation in invention," and "Reversal." ELECTRIC POWER for October and subsequent issues of '95.

Electrical Cooking and Heating Apparatus. Various utensils are described and illustrated. *Elektrotechn. Anzeiger*, Oct. 3, '95.

Fusible Cut-Out for High Tension Currents. Description with illustrations of an article in *L'Electricien*, Oct. 5, '95.

Electric Plow in Germany. Abstract of a report of the United States Consul at Leipzig. The various types of plows are illustrated and described and the advantages of the electric motor enumerated as follows: (1) far less expensive to make than steam plows; (2) far lighter in their construction and, consequently, more portable; (3) they can be used at a far greater distance from the actual source of power, thus saving much haulage. Numerical calculations, partly based on statistics, partly on lately performed experiments, form not the least important part of the paper. *Western Electrician*, Oct. 12, '95.

Electric Railways and the Electric Launch Season of 1895. A review of the accomplishments during this year, with many illustrations of new devices. *Elec. Engineer*, Oct. 16, '95.

Electricity in the Italian Navy. By Guilio Martinez. A series of articles written with the authorization of the Italian Naval Department. *Elec. World*, Oct. 19, '95. Subsequent issues.

How Shall We Heat Our Cars. By J F. McElroy. Paper read before the Street Railway Assoc. of the State of New York, Albany, Sept. 17, '95. The speaker directed attention to some of the general principles involved in the construction and operation of electric heaters, and then presented some matters bearing upon the subject of the amount of heat produced and the cost of the same. *Western Electrician*, Oct. 19, '95.

Rating and Behavior of Fuse Wires. By W. M. Stine, H. E. Gaytes, and C. E. Freeman. Paper read before the Am. Inst. of Elec. Engineers, Oct. 23, '95. The most important part of this paper are the conclusions which the authors arrived at. These are: 1. Covered fuses are more sensitive than open ones. 2. Fuse wire should be rated for its carrying capacity for the ordinary lengths employed. 2 *a*. When fusing a circuit, the distance between the terminals should be considered. 3. On important circuits, fuses should be frequently renewed. 4. Inertia of a fuse for high currents must be considered when protecting special devices. 5. Fuses should be operated under normal conditions to ensure certainty of results. 6. Fuses up to five amperes should be at least one and one-half inches long, one-half inch to be added for each increment of five amperes capacity. 7. Round fuse wire should not be employed in excess of 30 amperes capacity. For higher currents flat ribbons exceeding four inches in length should be employed. *Elec. Review*, Oct. 30, '95; *Elec. Review*, Nov. 6, '95.

Calculation for the Distribution of Electrical Energy. By J. Rodet. A mathematical deduction comparing various methods. *L'Industrie Electrique*, Nov. 10, '95.

Electric Tricycle. An invention of Chas. H. Barrows. The forward wheel is the driving wheel, made up of one tube, two sets of spokes and solid rubber tires. Current is obtained from a primary battery, contained in two cabinets, each 24 × 8 × 8 inches. Full description with illustration may be found in *Scientific American Supplement*, Nov. 16, '95.

Automatic Shoe Blacking Machine. Description of a coin-operating device and illustration of the interior mechanism. *Western Electrician*, Nov. 20, '95.

The Middle Conductor in the Three-Wire Installation. By E. Lohr. Various suggestions as to the construction of the neutral wire. *Elektrotechn. Zeitschrift*, Nov. 28, '95.

Department of Electricity at the Atlanta Exposition. By Luther Stieringer. An article reviewing the work of the last few years, and theorizing on the possibilities of the future. *Electricity*, Nov. 30, '95.

Some Features of the Atlanta Exposition. Illustrated description in *Elec. Industries*, Dec., '95.

Transformer Testing. By Eustace Oxley. Tests should be made, the writer claims, of insulation, magnetizing current, core loss, efficiency and drop. Several methods of testing are pointed out. *Elec. World*, Dec. 8, '94.

Electro-Pneumatic Continuous Brakes. M. G. Lesourd has described in a paper read before the Société des Ingénieurs Civils de France, on November 22, the Chapsal electro-pneumatic brake. With continuous brakes worked on either the pressure or vacuum system, when the train is very long, the distribution of pressure will take some time to effect itself, and the braking action will not be simultaneous all along the train. Various devices have been adopted

to obviate this, with more or less success. That of M. Chapsal is an electrical apparatus. Two wires for putting on and taking off the brakes run the whole length of the train. These work valves under each carriage, and in the case where the system is applied to the Westinghouse brake, the upper part of the triple valve is modified. M. Lesourd illustrates his description by models worked with a cylinder of compressed carbonic acid, but the *Bulletin* gives no detailed description of the apparatus. It was claimed, however, that it was exceedingly efficient, and at the close of his demonstration M. Lesourd was complimented by the president. The Chapsal apparatus, with some modifications, can be applied at comparatively small expense to almost any existing system of continuous brakes. *London Elec. Engineer*, Dec. 13, '95.

Concentric Wiring. By Sam. Mavor. Abstract of a paper read before the London Institute of Elec. Engineers, Nov., '95, appeared in *Electricity*, Dec. 18, '95.

New Features in Advertising. A well illustrated article, showing the application of æsthetic light effects. *Elec. World*, Dec. 21, '95.

The Electric Railway Street Sprinkler. L. W. Campbell is the patentee and inventor of a new railway street sprinkler. It is a trolley car consisting of a large tank. Illustration appeared in *Scientific American*, Dec. 21, '95.

The Electric Wiring Question. By Fred. Bathurst. Paper read before the Institution of Elec. Engineers, Nov. 28, '95. After speaking on the development and growth of wiring, author claims that the principal obstacle to the general use of electrical applications is the impossibility to place the cost of installation within reach of the great bulk of our people. He then goes into the technical requirements. He said: The five cardinal points may be given as safety, durability, convenience, accessibility and economy. Prof. S. P. Thompson, in a lecture on the subject before the Society of Arts, has embodied the essential features in a few words when he said: "What is wanted is a mode of running wires and fixing switches and other accessories, so that they shall not only be electric tight, but shall also be water-tight, gas-tight, air-tight, oil-tight, fire-tight, and even rat-tight." The only "tight" he has omitted is "money-tight." It is my belief that all these requirements can be met by the use of fire-proof insulating tubes. *London Electricity*, Dec. 6, '95, and subsequent issues; *Electricity*, Dec. 25, '95.

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